SCIENTIFIC AMERICAN

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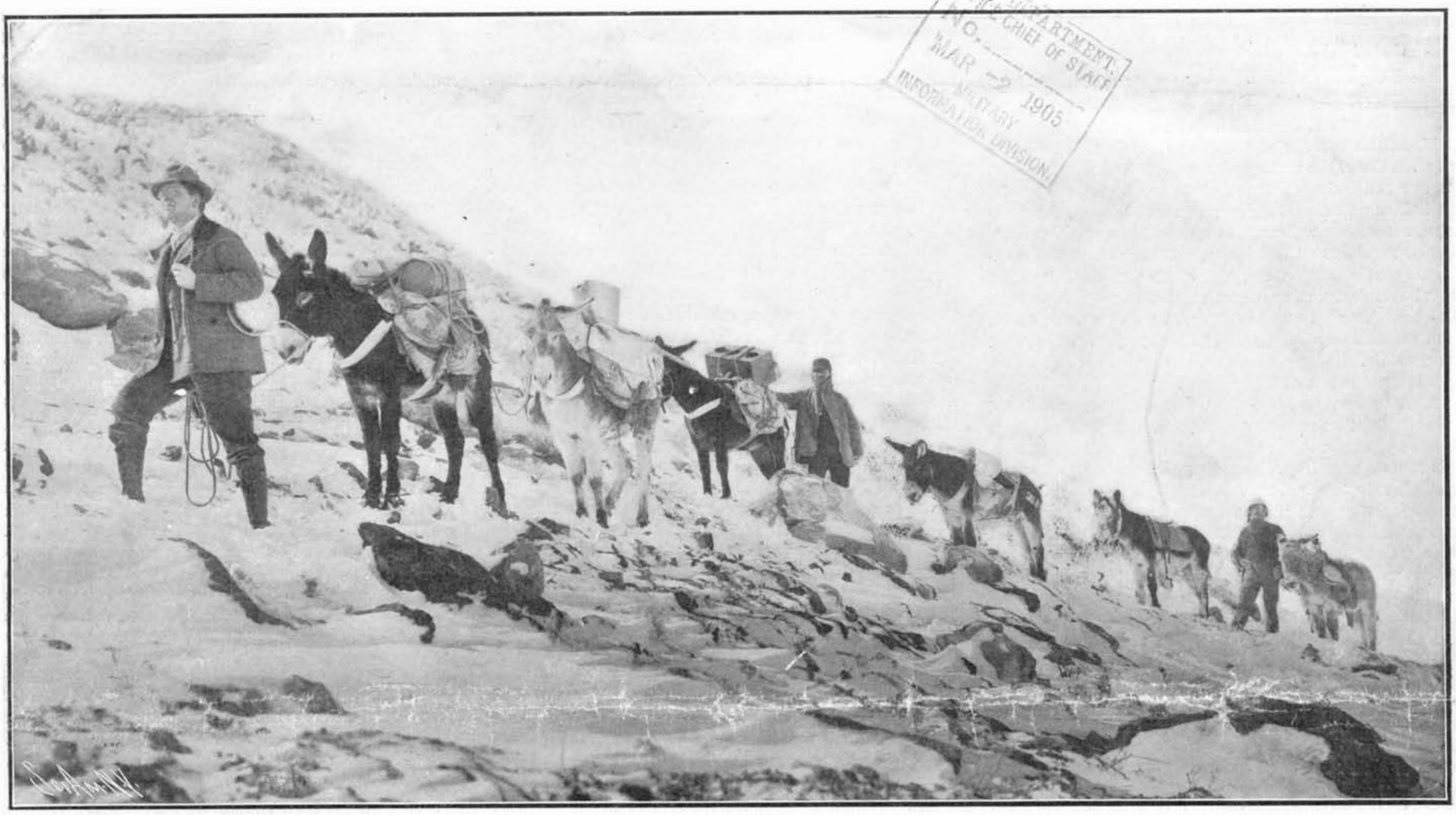

View of a Modern Prospecting Expedition in the Rocky Mountains, Showing the Method of Packing the Supplies and Other Equipment.

Loading Sacks of Gold and Silver Ore on Wagons for Shipment to the Smelters.

MODERN METHODS OF GOLD PROSPECTING.—[See page 181.]

SCIENTIFIC AMERICAN

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NEW YORK, SATURDAY, MARCH 4, 1905.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

STEEL CARS AND SAFE TRAVEL.

If, as the records of the Interstate Commerce Commission show, the majority of the injuries and fatalities on our railroads are due to collisions and derailments; and if, as unfortunately seems to be the case, the management of our railroads is unable to reduce the number of accidents of this kind; in other words, if derailments and collisions are, under existing conditions, an inevitable feature of modern railroading—then perhaps the best thing we can do is to render our rolling stock, and particularly our passenger cars, as collision-proof as possible.

The steel car is collision-proof.

A few years ago, a certain company began to build steel freight cars; and, of course, the first of these that were sent out upon the road were not long in running into a smash-up. Here they demonstrated, at once, their ability to stand an amount of pounding, crushing, and wrenching which would reduce a wooden car to the proverbial kindling wood. After such a collision, what was left of the wooden cars was burnt on the spot; but the steel cars were unearthed from the wreckage of their older and frailer brothers; their trucks were replaced beneath them; and they were hauled off to the car shops to have the kinks taken out of them.

In a heavy collision, it is the telescoping of one car into another that kills and wounds the passengers; but steel cars cannot telescope. Even with the momentum of a heavy train behind it, the platform of the telescoping car is unable to shear its way through the vertical steel posts (angle irons, channels, or T-irons) which form the frame of the car body. Following the line of least resistance, steel cars, in such collision, will slide past each other, or be slewed around and rolled to the side of the track. In this case the injuries to the passengers will be only such as are due to their being thrown violently around, and will generally be limited to cuts and bruises. The all-steel cars of the New York Subway, and the composite cars with steel underframes, have probably already saved more lives and limbs of the public than the operating company would care to admit. Had the collisions which have already occurred taken place between wooden cars of the old type, the casualty list would have been very much longer.

The Interstate Commerce Commission has accomplished a splendid work in enforcing automatic coupling and the application of the air brake. It may be too early yet, but the time is surely coming when the same Commission will urge or enforce upon our railroads the use of steel cars. For obvious reasons such a great and expensive change could only be brought about gradually; but it will surely come, probably by the voluntary act of the railroads, and as the result of a growing appreciation of the safety and ultimate economy of this durable form of construction.

THE MILITARY METHOD OF EDUCATING BOYS.

The average American boy is splendid material, but in the rough he is conspicuous neither for order, system, nor respect for authority. The military system supplies the most effective remedy for these defects—effective because the remedy is sugar-coated. What boy with red blood in his veins is there, who does not feel a thrill at the tap of the drum or the sound of the trumpet, who does not delight to handle a rifle, or who does not simply glory in popping away with blank cartridges at an imaginary enemy in an infantry skirmish; or, if he is proof against these, who will not yield to the dashing interest of the mounted cavalry exercises, or to the artillery drill with its fascinating suggestions of power? What other method is there that will so surely and so quickly make the unpunctual boy on time to the dot, the untidy boy neat and trim, the bashful boy confident and assertive, the round-shouldered figure erect and full-chested?

The boy who at home, unheeding the gentle maternal protests, varies his rising hour indefinitely breakfastward, at the military school springs from his bed at the first note of the reveille, and dresses as though the house were on fire. The boy whose mother "picked up his things" for him at home, is now his own chambermaid; he makes his bed, sweeps his floor, keeps his furniture innocent of dust, keeps everything in its place. The boy who was accustomed to argue indefinitely with parental authority now obeys without question or delay the commands of the smallest and most youthful corporal. The boy who at home thought it looked "stuck-up" to stand and walk straight and slouched disfiguringly, goes about now with his head up and his chin in, his chest out and his stomach "sucked up," his figure straight and well poised and a goodly sight to see.

The military method, however, to be effective must be real, there must be no sham about it. It must not be too diluted, too modified. The military schools that have succeeded best are those that have been the strictest, and have trained their cadets in their military work as earnestly and exactingly as if the making of soldiers was the end in view, and not simply a means. The mere nattiness and glitter of the uniform can appeal only to the unworthy traits. If it is to appeal to the best there is in a boy, the uniform must stand for something more than a mere tickler of pride or fancy. The uniforms of the best military schools are eloquent of prompt and unquestioning obedience, of system and order, of setting-up exercises that square the shoulders and expand the chest, of drills with every detail accurately hammered out, of days of early rising and early to bed and of wholesome living, and of many other things which must of necessity exercise on the cadet's after life an important and lasting influence.

And not only must the military system, if it is to create the desired *esprit de corps*, be thorough and businesslike, but if it is to keep the cadet's interest from lagging, it must have its spice of variety. For it must be remembered that the cadet of the private military academy has not in most instances the incentive of a soldier's career ahead of him, but must gain his incentive solely from the temporary interest aroused by the military features of the school itself.

THE FREE-ALCOHOL QUESTION.

In a recent issue we pointed out the far-reaching effect which the removal of the tax on alcohol would have upon the industries of this country, and showed that the arguments in favor of free alcohol are based upon sound economic principles. There is no desire to remove the tax upon distilled spirits intended for consumption; that tax is perfectly proper and forms a useful source of revenue, against which no objection whatever can be urged. It is the denaturized alcohol, that is, alcohol which has been made undrinkable by mixture with noxious substances, and is, therefore, usable only in the manufacturing and the industrial arts, from which it is sought to have the tax removed. As matters now stand with us, alcohol for beverages and industrial alcohol are subjected to a tax of $1.10 on the proof gallon of 50 per cent alcohol. Commercial alcohol has a strength of 94 per cent, and the tax on it amounts to over $2 per gallon. Industrial alcohol, according to the Department of Agriculture, could be sold profitably, were there no tax upon it, for about 15 cents per gallon; and under the increased demand that would be sure to follow, it is probable it could be sold profitably for 10 cents a gallon.

Practically all of the leading nations of Europe permit the use of spirits in the various industries without the payment of duty. Great Britain permits a limited use of it, and in that country the Chancellor of the Exchequer has recently appointed a committee to consider the whole question of free alcohol. This committee is to inquire into the existing, but limited, facilities for the use of spirits in the arts and manufactures without payment of duty. It is composed of experts and large manufacturers of alcohol, some of whom have been active in showing how much the chemical industries of Great Britain, and particularly those involving the use of alcohol, have suffered through the restrictions of inland revenue regulation, while German chemical industries, because of these restrictions, have profited greatly at their expense. It seems that there are in that country over a hundred manufactured products, in the preparation of which alcohol is necessary; that many of the processes of production were discovered in England and originally used in that country; but that when Germany, with her far-sighted provisions for the use of alcohol free of tax in the industrial arts, came into the field, the British manufacturers were unable to meet the competition, many of the factories being abandoned, and others experiencing a hard struggle for existence. Although industrial alcohol, according to one authority, could be produced in England at from 16 to 18 cents per gallon, the revenue tax raises the price to $3.04 per gallon. As an example of the effect of this high cost on chemical industries, it is mentioned that dimethyl aniline, which Germany can produce for 7½ cents per pound, costs 57 cents per pound in England.

In a lecture recently delivered by one of the above-mentioned committee before the Society of Arts, stress was laid upon the fact that, when it is used with the incandescent mantle, alcohol forms a splendid and very clean illuminant, alcohol lamps being made on the Continent which are capable of giving as much as 1,000 candle-power, while 250 candle-power lamps are quite common. Moreover, the alcohol lamp vitiates the atmosphere to a sensibly less degree than any other illuminant, excepting, of course, the incandescent electric light. As a result of alcohol being an indispensable ingredient of many valuable dyes, medicines, and chemicals, there is a great importation into England of these articles from all continental countries in which there is no tax on industrial alcohol.

As regards the use of alcohol on the Continent, it is chiefly in the development of power, light, and heat that the industry has had its growth. This fact was emphasized in a recent meeting of the Automobile Club of Great Britain, where the statement was made that, although more progress had been made with alcohol for the propulsion of motor vehicles in France, the quantity consumed as fuel by internal combustion engines in Germany was far larger. Of the suitability of alcohol for the purpose there is no doubt whatever; the tests of the laboratory being amply confirmed by the subsequent work of the motors. The difficulty which inventors have to contend with in the production of alcohol motors, is that the heat of combustion of alcohol is about 100 per cent greater than that of gasoline; but the value of a fuel depends not upon its heat of combustion, but upon the number of heat units which can be converted into work. Out of the ten alcohol-driven engines entered in 1902 in the competition for the prize offered by the German Agricultural Society, three gave efficiencies of from 32.7 to 30.9 per cent when working under full load. The degree of compression in an alcohol motor is much higher than that of the gasoline motor. In come cases in these tests a compression as high as 10¼ atmospheres was used, and the greatest explosion pressure attained was 33 atmospheres—results which appear to prove that the higher efficiency of the alcohol motor is due almost entirely to the high compression which can be used. Gasoline has a specific heat very much lower than that of alcohol, and consequently the latter can stand a proportionately higher compression, before the pressure and temperature are carried to the point of ignition. Moreover, the alcohol used in the German experiments contained 10 per cent of its volume of water, which, of course, was conducive to a high compression.

On the other hand, a report sent in by the United States Consul-General at Marseilles, France, states that in that country the sale of alcohol motors has been unimportant, probably one hundred petroleum or gas motors being sold for one alcohol motor. The reasons alleged are the high cost of the alcohol, the greater consumption per horse-power, and the difficulties arising from oxidation. In a report prepared by the French Minister of Agriculture upon the competitions organized by his department, it is stated that if the use of alcohol could be rendered practicable, it would offer decided advantages in the merchant and military marine, where, in his opinion, the use of gasoline engines would be attended with considerable danger.

NEW TRADE-MARK LAW OF APRIL 1, 1905.

We have from time to time noted the progress of the Bonynge bill, which has been for some weeks before Congress, and which has been approved by both the House and the Senate. On Tuesday, February 21, the bill was signed by the President of the United States and has become a law. The new law goes into operation on April 1, 1905.

It has been understood for several years that the old law of 1881 was exceedingly unsatisfactory, and was not affording the protection that was sought after or expected by registrants. The decision of the Supreme Court in the case of Warner vs. Searle & Hereth Company, November 30, 1903, proved to be practically the deathblow to the old law, as under this decision it was not possible to recover damages for the infringement of a trade mark used in commerce between the States. Although long before this decision the necessity of having a broader and better law had become apparent to those who were interested in the welfare of the patent system, all attempts at procuring favorable legislation in the direction of correcting the evils of the old system had utterly failed, and it is with a great sense of relief, therefore, that those who have at heart the bettering of our trade-mark laws will learn of the enactment of this new act. Under its provisions registrants will secure much broader protection than has been possible before. Not only will it be possible to recover damages for infringement of trade marks used in foreign commerce and with Indian tribes, but it will be possible to protect trade marks used in commerce between the States. The mere fact of registration is *prima facie* evidence of ownership, and in case suit for infringement is brought, triple damages may be recovered from the infringer, if the circumstances are such as to satisfy the court that penalties in addition to the losses actually proved should be imposed.

Another very radical departure is the provision for

the registration of non-technical trade marks, under certain conditions. As is well known, it is not now possible to register trade marks which are descriptive in character, or which make use of geographical names. Under the new law, however, if such a trade mark has become identified with a certain class of goods for a period of ten years, such mark may be registered in the Patent Office. This is an entirely new departure from the old practice, and is a very important step in advance, and will be found instrumental in legalizing the ownership in a certain class of vested trade rights. It will also be welcome news that the government fee for the registration of trade marks has been reduced from $25 to $10.

One peculiarity of the new law consists in the fact that the Commissioner of Patents is required to publish in the Official Gazette all trade marks for which registration has been applied. Opposition may be filed against the registration of the trade marks during a period of thirty days following the publication of the notice in the Official Gazette. The act thus provides for protecting the rightful owners of trade marks from wrongful registration. Those who wish to obtain the benefits of the new law may re-register their trade marks by paying the office fees and filing new applications.

The new law provides wise regulations in regard to the carrying of appeals first to the Commissioner of Patents, and later to the Court of Appeals of the District of Columbia. It also regulates the conduct of interference proceedings within the Patent Office, and also provides for the carrying of appeals from the Examiner of Interferences to the tribunals mentioned above.

Foreigners have the same privileges under the new law as Americans, provided their governments accord similar protection to the citizens of the United States. A certificate for a trade mark applied for in a foreign country will not be issued, however, by the United States Patent Office until the trade mark has been actually registered in the country of origin.

It is believed that manufacturers and other owners of trade marks will make haste to avail themselves of the wise provisions offered by the new law.

THE HEAVENS IN MARCH.

BY HENRY NORRIS RUSSELL, PH.D.

A time like the present, when none of the bright planets is visible in the evening sky, is a good one to begin a study of the constellations.

If we go out at about nine o'clock on a clear evening in the middle of March and look about us, we will notice some bright stars in the southwest. One of these far exceeds all the others in brilliancy, and most of us will recognize this as Sirius, the brightest of the fixed stars. It is fully four times as bright as any other star that is visible in our latitude. A couple of familiar stars on each side of it and an irregular cross of brighter stars below, complete the constellation of Canis Major—an easy group to remember, though it takes a good deal of imagination to see in it any likeness to a dog.

To the right of Canis Major is Orion, marked by the "belt," a line of three equidistant stars inclosed by a large quadrilateral. Betelgeuse, the red star at the upper corner, is an irregular variable, being twice as bright at some times as at others, while the white stars which form the rest of the constellation do not alter in brightness.

Still farther to the right we come to Taurus, whose brightest star, Aldebaran, forms a regular diamond-shaped figure with Sirius and the two brightest stars in Orion. It lies at one extremity of a V-shaped group of stars known since Greek days by the name of the Hyades. The star between Aldebaran and the point of the V is a fine naked-eye double.

To the right of the Hyades lies the closer cluster of the Pleiades, whose six brightest stars are visible to an ordinary eye, while some twenty more can be seen with a field glass.

A mere glance at such a star cluster raises the question, Are these stars really near together (compared with their distance from us) or do they only happen to seem so because they are nearly in the same line, though at very different distances?

In the case of the Pleiades and the Hyades, we can say with certainty that the first alternative is the true one. In each of these clusters the stars are slowly moving, all in the same direction and at the same rate, so that their distances from one another do not appear to alter. They keep together like a flock of wild geese, and we have just as much reason to suppose they are really companions as we have in the case of the birds—in fact, more reason, for stars cannot change the direction of their flight at will.

This conclusion is still further supported by the fact that the stars of a group have a strong family resemblance in color and spectrum, which points to a common origin.

Neighboring stars of different color and spectrum generally show by their motions that they do not belong to the group. For example, Aldebaran does not share the drift of the Hyades, but is going in quite a different direction. The same is true in Orion, where all the bright stars except Betelgeuse have a common motion and similar spectra. In this case the motion is very slow, so that it is probable that these stars are exceedingly remote.

Still other groups of this sort are known, notable examples being five stars in the Great Dipper and a large group in the southern hemisphere including the brightest star in the Southern Cross.

But we must return to our survey of the heavens. A series of conspicuous constellations follows the Milky Way—Cassiopeia in the northwest, then Perseus, next Auriga, followed by Gemini with its twin stars, and then Canis Minor with the bright Procyon. Low on the horizon is part of the great constellation Argo.

The Dipper in Ursa Major and the Sickle in Leo are the most familiar figures in the eastern sky. Below the latter is the long line of Hydra. The bright stars Spica and Arcturus have lately risen, but the constellations to which they belong will be better seen in the following months.

THE PLANETS.

Mercury is morning star until the 9th, when he passes behind the sun and becomes evening star. He is invisible except at the end of the month, when he sets more than an hour later than the sun.

Venus is evening star in Aries, and is very conspicuous, as she does not set until about 9 P. M. She is at her brightest on the 21st, surpassing even Jupiter by more than a magnitude. The smallest telescope or even a good field glass will show her as a crescent like the moon two or three days before first quarter.

Mars is in Libra and rises at about 11 P. M. in the middle of the month. He is growing brighter as he comes nearer to the earth, but is not nearly as conspicuous as he will be in May.

Jupiter is evening star in Aries, close to Venus. The two planets are nearest on the 8th, when Venus passes north of Jupiter at a distance of about five degrees.

The moon is near by at the time, and passes close to the two planets the following evening, so that this is a very brilliant conjunction.

Saturn is morning star in Aquarius, and rises about 5 A. M. in the middle of the month.

Uranus is morning star in Sagittarius, rising at about 2 A. M. On the 25th he is in quadrature with the sun, and comes to the meridian at 6 A. M.

Neptune is in Gemini. He is also in quadrature on the 26th, but is east of the sun and so comes to the meridian at 6 P. M.

THE MOON.

New moon occurs at 1 A. M. on the 6th, first quarter at 4 A. M. on the 14th, full moon at midnight on the 20th, and last quarter at 5 P. M. on the 27th. The moon is nearest the earth on the 21st, and farthest away on the 8th. She is in conjunction with Saturn on the 4th, Mercury on the 5th, Jupiter and Venus on the 9th, Mars on the 24th, and Uranus on the 25th.

There is an annular eclipse of the sun on March 5. It is invisible in the United States. The track of central eclipse lies chiefly in the southern Indian Ocean, crossing no land except part of Australia.

Sidmouth, England, February 8, 1905.

GRANDFATHER'S BAROMETER.

BY B. L. PUTNAM.

Not a dainty affair with silver or satin trimmings, nor yet with the credentials of Uncle Sam attached; but a constant companion, shifting from woods and fields to skies—this was the weather bureau of our grandfathers; and mingled with the signs and omens of old there was just enough of fact that the old-timer sometimes gets the best of it now in foretelling the weather.

"Rainbow at night, sailors' delight;
Rainbow in the morning, sailors take warning;
Rainbow at noon, rain very soon."

Just adapt this couplet the next time a rainbow comes your way, and see for yourself.

A combination of rain and sunshine was also supposed to bring rain the next day.

Another verse which found favor was—

"Evening red and morning gray
Will set the traveler on his way:
Evening gray and morning red
Will pour down rain upon his head."

This is but an adaptation of the adage that a red sunset is a sign of clear weather. And if the sun goes down in a cloud rain will surely come the next day. If smoke from the chimney settles instead of excepting in dry weather, when, the prophet assures us, "all signs fail."

If it clears off in the night, look for rain the next day. If smoke from the chimney settles instead of rising, there is a storm at hand. When sound travels a long distance there is also a storm near. Never expect much storm in the old of the moon. The absence of dew and an unusually heavy dew are alike forerunners of rain.

Not much frost need be expected in the light of the moon. An owl hooting in the hollow is a sign of a cold storm; on the hill, it foretells a thaw.

If the hornets build low the winter will be hard. When leaves fall early the winter will be long. When snow falls on a hard road it will not last long. The last spring snow storm never comes until after the "sugar snow," which may be recognized by coming in unusually large flakes and only lasting a few minutes. If the hog's melt is found big at the front the first part of winter will be the most severe; if the reverse is true, we may look for hard weather in February and March. Bright "northern lights" bring severe cold. If the sun shines on the second day of February so as to permit the woodchuck to see its shadow, it will go back into its hole and remain six weeks. If March comes in like a lamb it will go out like a lion; if it comes in like a lion it will go out like a lamb. In other words, one extreme at the beginning promises the reverse at the end of the month. Sun-dogs indicate a bad storm.

Distant sounds heard distinctly forebode no good weather. If the sun "draws up water" it will rain. The pitcher sweating and the tea-kettle boiling dry also indicate rain. Cobwebs thickly spread upon the grass are an indication of fair weather.

Animal life seems, according to the popular notion, to have peculiar warnings regarding the weather changes. Some of these are explainable by natural causes. It is a fact recognized by all intelligent stockmen that cattle have an intimation of an approaching storm some hours before it is visible to the human eye. There is a certain restlessness which the cowboy has learned to interpret at once. When you see a pig pasturing in the field build for itself a nest you may look for a storm. Chickens take extra pains in oiling their feathers just before a rain. Pea fowls send forth their shrill cries as a warning, and when the quail cries "more wet" from the meadow, the farmer works briskly to get his hay under shelter. If the chickweed and scarlet pimpernel expand their tiny petals, rain need not be expected for a few hours. Bees work with redoubled energy just before a rain. If the flies are unusually persistent either in the house or around stock there is rain in the air. The cricket sings at the approach of cold weather. Squirrels store a large supply of nuts, the husks of corn are unusually thick, and the buds of deciduous trees have a firmer protecting coat if a severe winter is at hand. If the poplar or quaking asp leaves turn up the under side rain will soon follow.

If the fog rises in the morning, it is a sign of rain; if it settles, a clear day may be expected. Watch the smallest cloud you can see. If it increases in size it is going to rain; if it melts away and vanishes completely, fair weather will follow.

If the camphor bottle becomes roily it is going to storm. When it clears, settled weather may be expected. This idea has seemingly been utilized in the manufacture of some of our cheap barometers. The main trouble is, they seldom foretell the change until about the time it arrives.

Last, but not least, the rheumatic can always tell it "in their bones" when a storm is approaching, and to this prognostication the octogenarian of to-day is as firm an advocate as were his forefathers.

SCIENCE NOTES.

MM. Chanoz and Perrigot have been attempting to repeat an experiment made by M. Bordier, who showed that N-rays emitted by tempered steel could apparently be detected by photography. The former, however, found that equal sized pieces of steel and of lead, placed on exactly similar screens, and exposed for various periods, never gave different halos, as described by M. Bordier.

In June, 1903, the English Astronomer Royal published the statement that there was a discrepancy in the determination of the longitude between the Greenwich and Paris observatories. It was also stated that independent, though simultaneous, observations to rectify this error were to be undertaken by two observers in France. This work has now been completed, and at a recent meeting of the Paris Academy of Sciences, M. Loewy, director of the National Observatory, exhibited the results of the French observers. This is in remarkable accord with the results of the English observers. The difference only amounts to three hundredths of a second, being in actual figures 9 minutes 20.974 seconds. From this it is deduced that Paris stands on a meridian which is east of the meridian of Greenwich, and that its noon is this amount in advance of that of Greenwich. The results of these observations, and their close agreement with the previous work carried out for this purpose in 1888 and 1892, testify to the commendable exactitude of the operations of both the English and French astronomers. According to M. Loewy, the results of this last investigation establish precisely and definitely the difference of longitude between the two fundamental meridians of the respective observatories.

THE LARGEST FERRYBOAT IN THE WORLD.

BY H. E. WRIGHT.

The steamer "Solano," the largest ferryboat in the world, crosses the Straits of Carquinez, carrying the trains of the Southern Pacific between Port Costa, Contra Costa County, and Benicia, Solano County, California. She was built in 1879 and launched in November of the same year. Her construction resembles that of a huge scow, stiffened lengthwise by four wooden trusses, one under each of her four tracks. Her hull measures 64 feet 10 inches in beam and 116 feet 8 inches over the guards. She is a double-ender, with four balanced rudders at each end, controlled by hydraulic steering gear. The "Solano" is propelled by two simple walking-beam engines of low pressure. Each engine has a 60-inch cylinder with an 11-foot stroke, and its horsepower is 2,252. Each engine drives one wheel, and works independently of the other. The wheels are 30 feet in diameter, and each has twenty-four buckets.

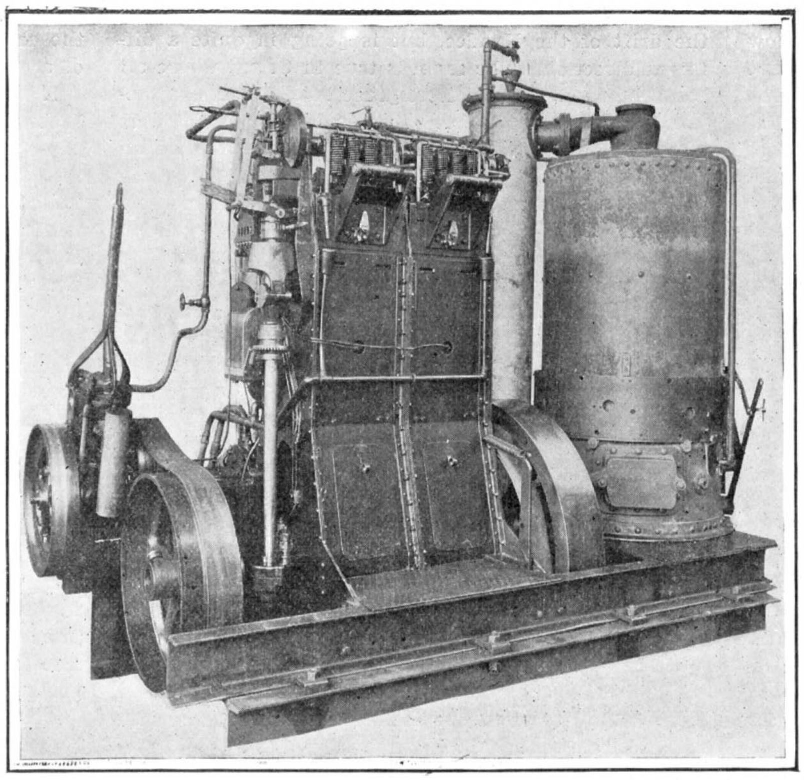
The steamer has eight steel boilers, 24 feet 10 inches long and 84 inches in diameter, and carrying 40 pounds steam pressure. Six of these boilers are in use every day. Once in three weeks two are laid off, when the scale that has accumulated is removed with crude soda. Petroleum is used for fuel. Every twenty-four hours 3,200 gallons are consumed. The tanks hold 8,300 gallons. It takes 50 minutes to fire up.

The "Solano" has 424 feet of deck length and is 406 feet 7 inches on her keel. Her registered tonnage is 3,549 tons. Approximately, she has been handling 115,000 freight cars and 56,000 passenger cars a year. She is double-crewed, with seventeen men in each crew, and runs night and day, making from thirty-six to forty-six crossings in twenty-four hours.

The length of her trip is one mile. The average time of transfer including time required to cut trains, place them on the boat, cross the straits, unload, and couple on the other side, is about eleven minutes. Road engines handle one cut on and off the boat; a switch engine handles the other cut. The boat draws, light, 6 feet 4 inches, but draws 10 feet 7 inches when loaded.

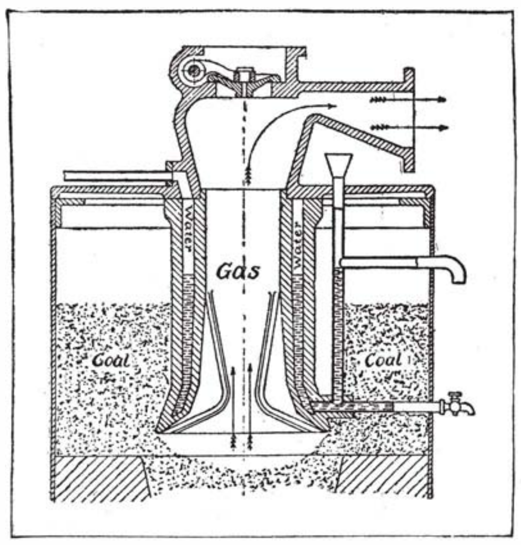
The hinged steel aprons, weighing 190 tons, over which the cars are transferred from the dock to the boat, are four-track spans, 100 feet long. These are controlled by air-tight pontoons and counter-weights which are handled by hydraulic power from pressure pumps located on the boat itself, connection being made by means of pipes and ordinary air-hose coupling.

As the boat enters the slip, the counter-weights are raised by hydraulic power, leaving part of the apron unbalanced. This sinks the pontoon. The apron descends to the level of the deck, the end fits into a recess on the boat and is firmly latched down. The counter-weights are released, and the apron and the boat are free to rise and fall with the tide.



Floor Space, 3½ by 7½ feet. **Weight,** 2¾ tons. **Horse-Power,** 30.

A COMPACT MARINE PRODUCER-GAS ENGINE.



Section of Top of Capitaine Gas-Generator.

THE CAPITAINE MARINE PRODUCER-GAS ENGINE.

An interesting type of marine internal-combustion motor has been introduced upon the European market. The plant comprises the engine itself, together with a producer-gas installation providing the necessary fuel for the motor. The application of this type of engine is a new development in power craft; and though its utilization is to a certain degree limited, owing to restrictions in space and weight, yet for purposes where weight is not an all-important problem, such as in tugs, barges, and large sailing vessels, it is admirably suited, owing to the low cost of maintenance. This latter fact is the most salient feature of the Capitaine plant, herewith illustrated, it being possible to operate a 10-horse-power engine at a running cost of two cents per hour.

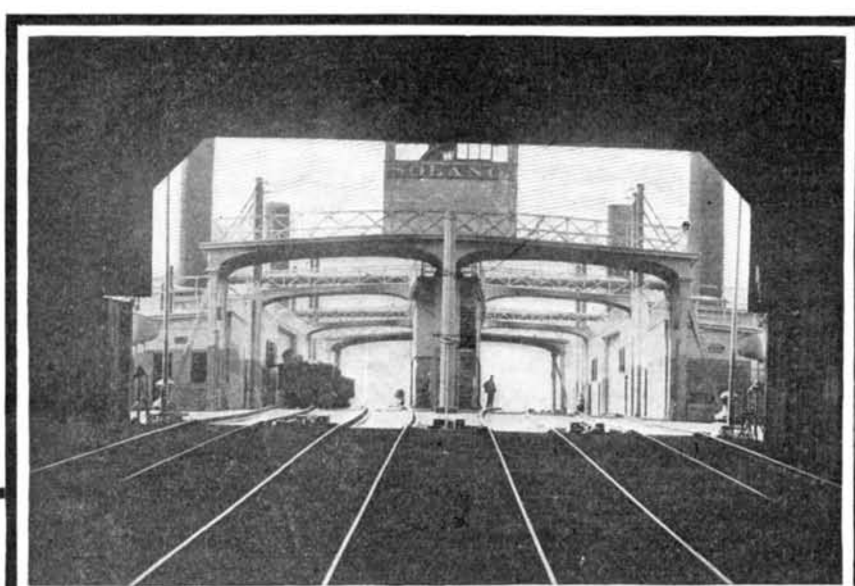
The plant primarily consists of a generator for the supply of the fuel, cooling and scrubbing apparatus, and the motor. It is due to the inclusion of the scrubber and cooler that the space requisite for the accommodation of the plant as well as the weight are somewhat increased, but their presence is absolutely essential to the satisfactory and efficient operation of the engine. In the first place, the gas supplied from the generator is of such a high temperature that it must be passed through the cooler to condense it sufficiently for complete and proper combustion in the engine, while at the same time, in order to prevent clogging of the latter, it must be submitted to the scrubber, to cleanse the explosive vapor from the particles of dirt and other foreign substances suspended therein.

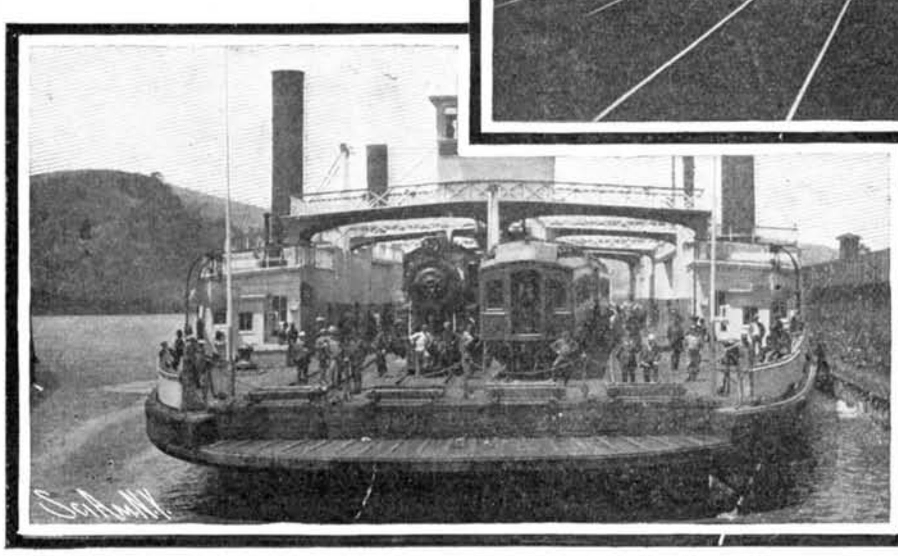
The plant shown in the accompanying illustration is one that is now being subjected to exhaustive experiments by Sir John Thornycroft & Co. It comprises a two-cylinder engine, developing 30 horsepower, and the gas generator, and is designed for installation upon a heavy type of commercial craft. The floor space occupied by the installation is 7 feet 6 inches in length by 3 feet 6 inches in width, while it weighs 2 tons 15 hundredweight. The cylinders are 8.27 inches diameter and the stroke is 11.02 inches. The normal speed of the engine is 200 revolutions per minute. The pressure of the compression is 175 pounds per square inch; the explosion pressure ranges from 400 pounds to 500 pounds per square inch; while the M. E. P. is about 100 pounds per square inch.

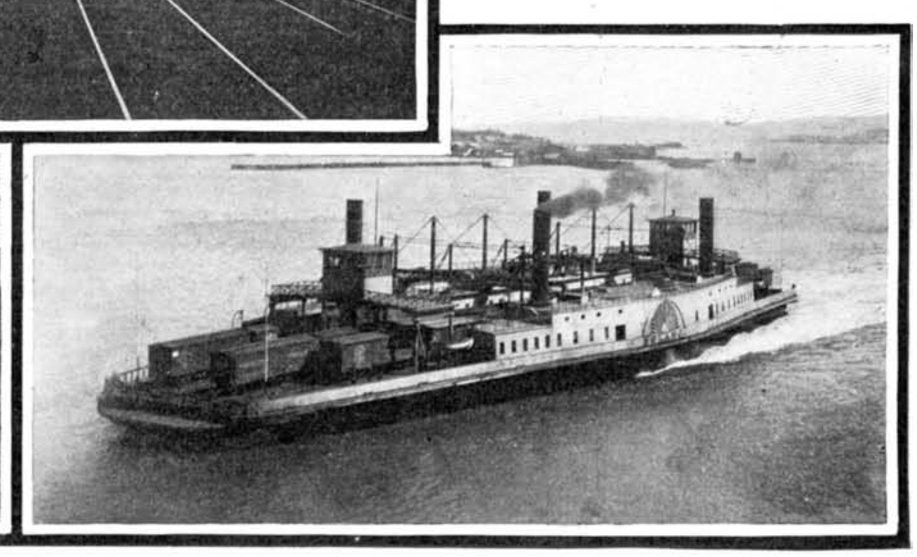
The gas-generating portion of the plant comprises a large drum, and consists of a shell lined with firebrick for a depth of about 4 feet. The space above this section contains a water reservoir. Small coal is placed in the generator from the top, and the coal space is entirely filled. The gas generated is a combination of producer and water gas, which are produced simultaneously. When the fire is started and the steam raised, the latter is directed through the blowpipe on to the grate at the same time as a current of air is injected. The grate is a dished plate somewhat larger in diameter than the brick-lined coal area, and is placed slightly below it, so that a ring of red-hot coal is formed round the edge of the plate and exposed to the jets of steam and air that are injected. The height of this plate can be regulated as desired by means of a rack and pinion actuated by a large lever working on a quadrant. The water reservoir is a conical bell-shaped casting, which is suspended from the cover and is sunk in the coal bed. The gases flow through the center, the water being so arranged as to surround the reservoir.

The grate is provided with two small doors, one on either side of the drum, through which the ashes are withdrawn. To the back of the generating tank are attached two cocks, one serving the functions of an overflow and the other a drain cock to the water receptacle. When the fire is first lighted, more air is required than can be admitted through the orifices provided for this purpose. When the motor is running, this increased supply is in-

(*Continued on page* 182.)







The "Solano" Entering Her Slip. "Solano," Loaded, in Mid-Stream.

View Looking Along the Deck, Showing the Four Tracks.

A GREAT CALIFORNIA RAILWAY FERRYBOAT.

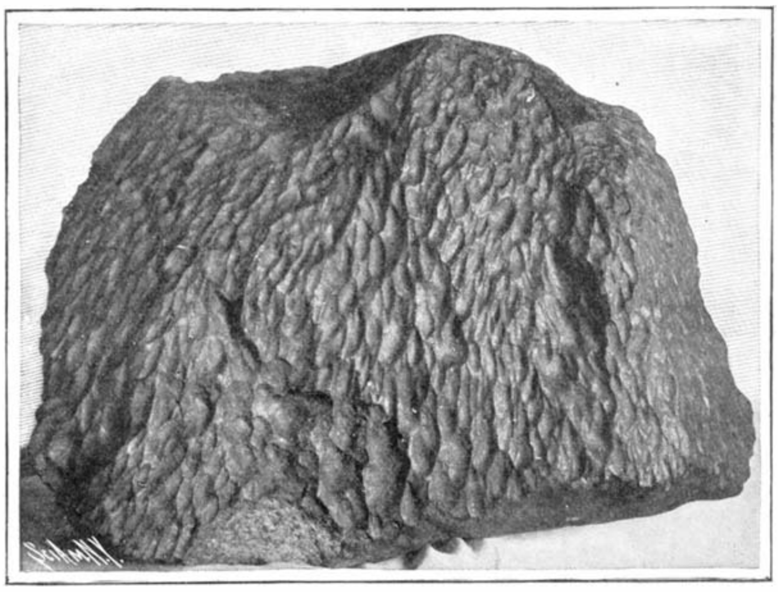
A NEW METEORITE RECENTLY PLACED IN THE AMERICAN MUSEUM OF NATURAL HISTORY.

On January 26 last there was placed on public exhibition at the Natural History Museum a new meteorite, one of the most remarkable of its class in the world. Prof. Henry A. Ward, of Chicago, read a paper before the regular meeting of the New York Mineralogical Club at the Natural History Museum, Wednesday evening, January 25, and gave a description of the meteorite. He stated that the Bath Furnace is an aerolite, or stony meteorite, which was seen to fall in the early evening of November 15, 1902, after a long luminous course through the heavens over Ohio and Kentucky, and its light was visible even to observers in Tennessee. Its course was N. 81 sec. E. until it reached the ground in Bath County, about fifty miles east of Lexington, Kentucky. The first description of the meteorite was published by Prof. Arthur M. Miller, of the State College of Kentucky. The few residents of the region where the pieces struck were much startled by the blinding light and the heavy detonations accompanying the fall. They spoke of the singing of the fragments as they flew through the air, and one eye-witness writes: "It sounded like a great buzz-saw ripping through a plank and coming at me through the air." Before striking the ground the mass broke into several fragments, three of which have been found.

The first-found piece fell at 6:45 P. M. in the road in front of the house of Buford Staten, near the old Bath Furnace, some five miles south of Salt Lake, and was picked up by him the following morning. It was about 8½ x 6 x 4 inches in extreme dimensions, and weighed 10 pounds 10½ ounces. It had cut a furrow about a foot long and three inches in greatest depth in the hard road where it first struck. A second piece, weighing half a pound, was found one hundred yards west of the first.

The third piece, the one which has now found a resting-place in the Ward-Coonley Collection at the Museum, was found by a squirrel hunter, Jack Pegrem by name, in May, 1903, about one and three-quarter miles south of the place where the other two pieces had been picked up. Mr. Pegrem's attention was attracted by a fresh scar on a white-oak tree some fifteen feet from the ground, and by the broken roots of a larger tree a few yards distant. Searching in the hole among the roots, he found a great stone buried less than two feet below the surface of the ground and crowded in among the roots, some of which had been severed by the collision.

This mass, as shown in the photograph, is one of the most completely furrowed and highly oriented aerolites known to science, and no other stone of American fall, at least, equals it in this respect. The mass is approximately a triangular prism in shape, and the furrowing of the bulging top and three sides is most complete. These furrows radiate from one point, or knob, in all directions, streaming back upon and over the sides. The regularity of the trend of the furrows is most interesting, as showing the steadiness of the mass in the air and the constancy of position of its axis, which doubtless was promptly taken after it entered our atmosphere and was retained throughout its whole flight. It owes this to the position of the center of gravity with reference to the shape of the mass.



BATH FURNACE NO. 3 METEORITE SHOWING A PECULIAR PITTED FORMATION.

In falling through space great heat occurs on the exterior of the mass, from which the melted particles are instantly brushed away as they form. It thus results that the brilliantly-glowing mass is in fact mainly cold. It brings with it the temperature of celestial space, which has been estimated at 504 deg. Fahrenheit below zero. This meteorite is thought to be the third aerolite in weight (184 pounds) ever found on our hemisphere. Iron meteorites run much larger.

The Bath Furnace aerolite, we find on examining its composition, is a base of fine, compact olivine and enstatite—both silicates of magnesia—with abundant sparkling points of nickel iron. It also has numerous white and gray spherical chondri of like material distributed through it, and breaking firmly with the mass. Its surface shows both primary and secondary crust.

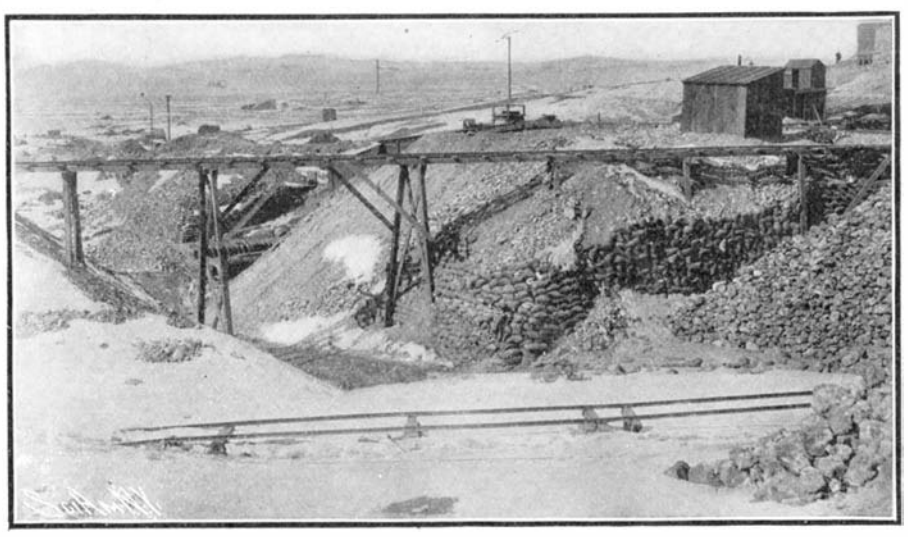
Its component minerals are allied to those of terrestrial volcanic rocks; but like other aerolites, it shows nothing of the melted slag structure of lavas. Stony meteorites apparently show us unchanged minerals from inner parts of the parent cosmic body. They bring us no new mineral elements, and a review of their chemistry shows that they yield only those elements which we know to exist on our globe. We may justly conclude that the most distant regions in stellar space contain only a repetition in varying proportions and combinations of the same elementary substances as obtain upon our earth.

Reichenbach has shown that a body like a meteorite, in falling through the atmosphere at the rate of forty miles per second, would have, by reason of air compression, a heat on its surface of over 7,200 deg. Fahrenheit, forming by melting and rubbing the peculiar glazing, pitting, and hollowing and channeling appearance which we find on the front and sides of meteorites.

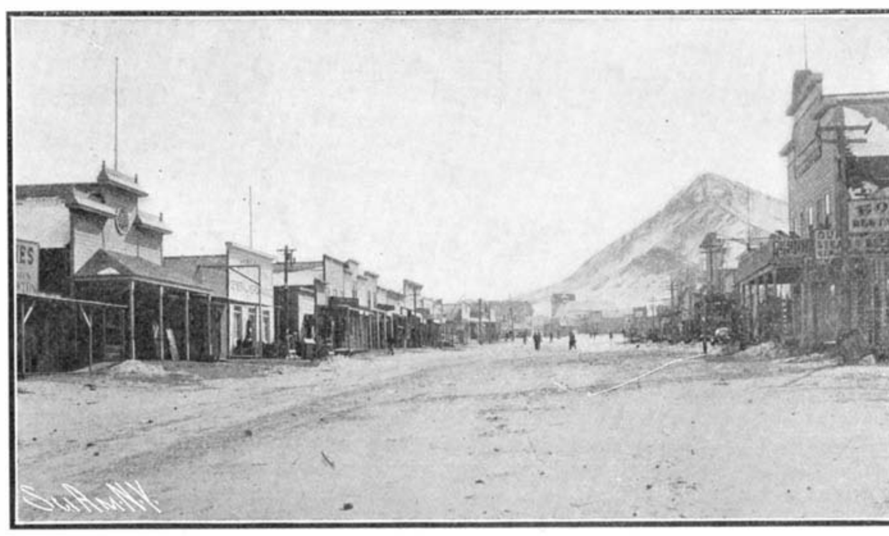
MODERN METHODS OF GOLD PROSPECTING AND MINING.

BY DAY ALLEN WILLEY.

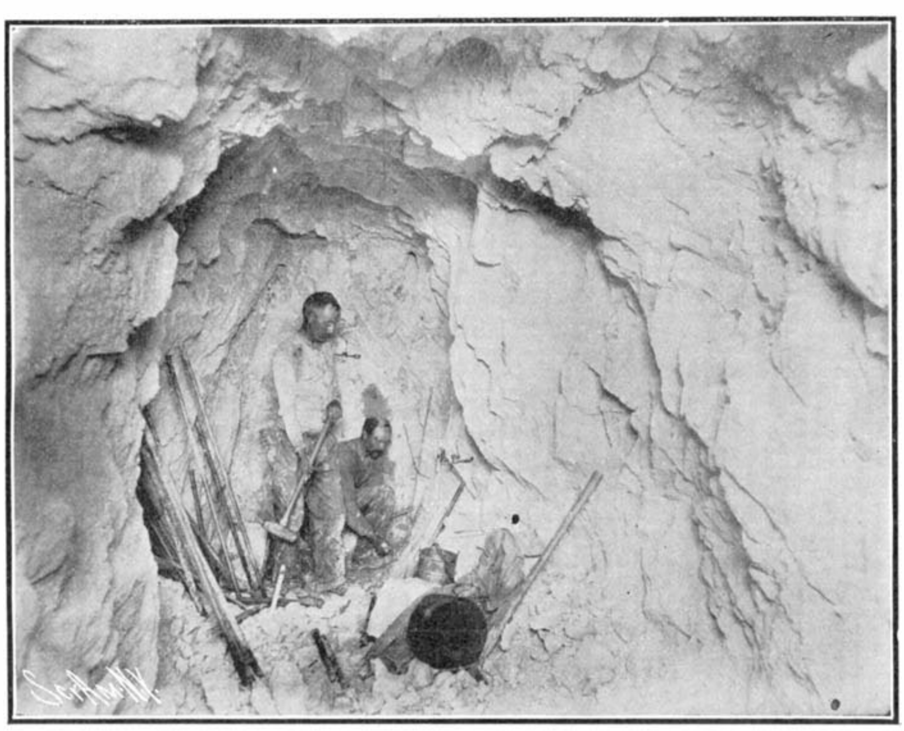
During the year 1903 the estimate of precious metal obtained from all of the districts controlled by the United States, outside of the Klondike, represented 25 per cent of the world's production of gold, and 33 per cent of the world's production of silver, being 3,600,000 ounces of gold and 56,500,000 ounces of silver. In 1895 the various States and Territories produced but 2,255,-



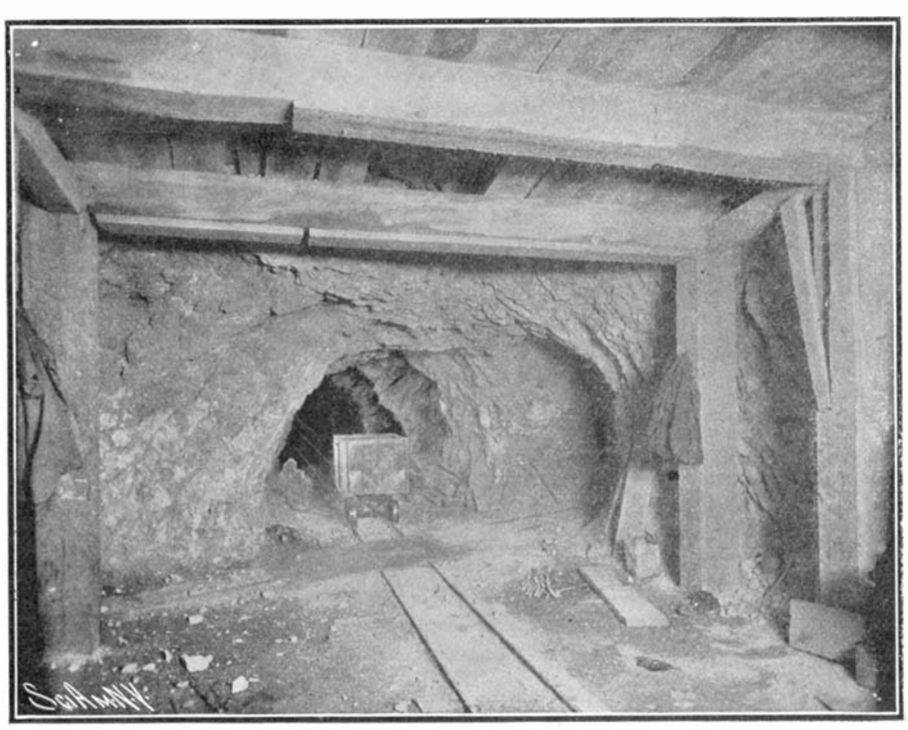
A Nevada Mine, Showing Piles of Ore Loose and Sacked for Shipment.



Street in Tonopah, One of the Mining Towns of Nevada.



Opening a Gallery From a Test Shaft to Secure Specimens of Ore for Analysis.



A Test Tunnel in the Rocky Mountains.

MODERN METHODS OF GOLD PROSPECTING.

000 ounces of gold. Consequently, the yield from the gold mines has increased 60 per cent in less than a decade.

In seeking the reasons for this truly remarkable development, one is especially prominent—the great advance which has been made in the methods followed by the modern gold seeker. The prospectors have taken advantage of progress in geology, chemistry, and other sciences, and have provided themselves with mechanical aids which are far superior to the crude implements employed by the metal hunters of the past. Their examination has not been confined to merely the bed of a creek or the side of a mountain, but often is so extensive that it embraces miles of area. Many a prospecting tour rises to the dignity of an expedition, and embraces a variety of apparatus, to say nothing of a staff of geologists and other experts.

In the old-fashioned system, as it might be termed, of seeking precious metal, the prospectors can be divided into two classes—those who are satisfied to obtain the metal in any form, and the "pocket hunters." The latter individual considers himself above the other type of prospector, terming his calling professional. Many a one has spent the better part of his life in exploring beds of streams and dry valleys in search of pockets. In southern Oregon the pocket hunters have been perhaps more numerous than elsewhere in the United States proper, as this section of the State has yielded a large amount of gold in this form. Pocket prospectors depend upon the pick, shovel, and pan as do their fellows, but they seldom dig further into the side of the bank or hill than their shovel will reach.

The ordinary prospector wades through the bed of the stream or tramps through its sand if it is "dry," here and there filling his pan with the material. Then immersing the pan in water, he thus separates the sand from the other matter, and gradually spilling out the sand, eagerly gazes at the bottom of the pan to note any glittering streak which may betoken the presence of gold. If he is working along the side of a hill where he believes the ledge of rock may contain a vein of gold-bearing ore, he breaks off likely portions with his pick, crushes them as best he can, and dumping the dust and fragments into his pan, repeats the separation process. In the examination of rock for metal-bearing ore the *arrastra* of the Mexicans and Spaniards has been used extensively, especially in California and Oregon. This contrivance consists of a vertical shaft or axis, which supports several wooden bars fastened at right angles to it. To the ends of the bars are attached heavy flat stones, which by the movement of the axis revolve in a circular pit. The specimens of ore are placed in the pit, a stream of water turned upon them, and the *arrastra* placed in motion by animal or water power. The ore is resolved into a slimy sediment by being ground in the water, and passes off through the sluiceway, which is provided with riffles for catching the gold.

The modern methods for searching for deposits of precious metal are so radically different from those described, that it may be said a revolution has taken place in prospecting in the United States. In the Rocky Mountain region the formation has been pierced as far as 2,000 feet in the effort to ascertain the existence of a vein, or the dimensions of one already discovered. Some of the projects which have been carried out preliminary to the opening of mines, represent an outlay of over a million dollars in the purchase of apparatus, the employment of noted experts, and in the general magnitude of the operations.

Among the mechanical appliances which have been of great assistance to the modern prospector is the drill. With it he can make borings in a week where if a shaft were sunk a year would be needed. If the formation is to be examined by a shaft, however, the cost of sinking it is reduced to a minimum by means of explosive cartridges, which are now manufactured especially for such service. They are ignited by means of the electric current, and it should be said that an essential part of the modern prospecting outfit is the chemical battery, which is not only of value for this purpose, but in the application of electrolytic methods to separating the precious metal from the dross.

Few expeditions of any size are sent out without an experienced geologist, who is usually provided with maps and other data giving the best information available regarding the region to be explored. Maps giving the extent of the claims, the direction of the veins, and the general topography of the region where the mine is to be opened are obviously of much value, and a draftsman is frequently included in the staff, with material for preparing the maps on the spot from the data obtained by the investigators.

Besides the geologist, the services of an expert chemist are also of great importance, and a laboratory in miniature is contained in the packs carried by the animals. So complete is this portion of the equipment, that a fairly correct field analysis can be made of the specimens secured by the use of the drill or by the other prospecting tools. If the outcropping of a quartz vein is discovered, enough is broken off to allow its character to be studied both from a geological and chemical standpoint. After examining it in connection with the formation in the vicinity, the geologist is often able to indicate where the surface can be bored with the possibility of reaching the ore-bearing strata at once. The value of the ore from the outcropping and that from the interior can be approximately determined by the chemist. To crush the ore is a slight undertaking, and with the lead which he has brought along, the material can be readily fused in a portable furnace. In fact, he has the essentials for making a "dry assay" on a limited scale, for cupels are now made of such light weight that they can readily be carried on muleback. Taking the ingot of lead and of precious metal, he can easily oxidize the lead by placing it in his cupel, and heating the latter to the required temperature in an oven constructed of material which he can obtain in the vicinity. With his nitric acid he separates the silver which may remain, leaving the gold only to be tested for its value. The proportion of the gold to a given quantity of ore can be determined by his scales, but by using his touchstone or black basalt, he can detect the quality of the gold by the color which this substance makes when drawn over the surface of the metal.

In the outfit of the modern prospector quicksilver has become practically indispensable. Its affinity for gold makes it a most valuable agent. Where the existence of placer gold is imagined, the introduction of mercury into the test washer soon solves the problem, and avoids the use of riffles and other crude appliances which were formerly depended upon almost entirely. After crushing the specimens of test ore, the quicksilver can also be used to ascertain the quantity of free gold among the particles. As the mercury can be eliminated by heating the composition to a sufficiently high temperature, it is now utilized in large quantities by the modern prospector.

THE CAPITAINE MARINE PRODUCER-GAS ENGINE.

(*Continued from page* 180.)

jected by means of an air blower driven by a gasoline motor. For some minutes the coal burns in precisely the same manner as it would in an ordinary furnace, and the combustion gases are allowed to escape through a chimney, though in their passage, by being directed through the center of the ring where the water is retained, they serve to gradually heat the water and prepare the steam ready for starting.

As the gas is produced and escapes from the fire of the generator at an excessively high temperature, it passes into the cooler. This part of the apparatus is shown at the left of the large generator, and consists of another drum of small diameter. The gas is first cooled at the top of the drum, by passing round a flat cooling coil through which a spray of water is passed, and it finally settles to the bottom of the scrubber, from which it is withdrawn by a pump. A fine spray of water is also forced upward from the bottom of this drum and strikes the wall about half way up. The result is that no gas can possibly emerge at the bottom without first having come into contact with the water jet, which arrests and carries off any impurities suspended in the gas. This process completed, the gas, comparatively cool and clean, is then deprived of the moisture with which it has become impregnated before it enters the engine. It escapes through a baffle at the bottom of the drum, and in so doing is partially dried, though to complete this operation it is conveyed to a centrifugal drier, consisting of a number of plates fixed on rings one behind the other in a small cylinder; this drier churns and agitates it until every trace of moisture has been completely removed. The gas is then ready for combustion in the engine.

In the gas produced by this process there is a larger percentage of carbon monoxide than carbon dioxide. The gas is consequently not very rich, but the resultant issue of this defect is that a larger cylinder capacity horse-power is required. The calorific value of the gas is 137 British thermal units per cubic foot. The formation of a larger percentage of carbon monoxide than carbon dioxide is preferable, inasmuch as less water is formed in the motor by the explosion of the gases than would otherwise be the case if there were a predominance of carbon dioxide. The formation of the greater quantity of carbon monoxide is attributable to the insufficiency of air, and consequently oxygen, injected into the generator during production.

The gas enters the engine through a double-seat valve, while an adjustable quantity of air can be admitted through the upper seating. In the arrangement of this motor, the cylinder valves are placed in the head of the cylinder, which can be removed by sliding forward after the release of the retaining nuts. The governing arrangement is ingenious. There is a quick-action governor, which when the maximum speed is exceeded grips a brass-ended fiber ring between two collars on the governor shaft. The governor also acts upon the low-tension magneto which is employed for ignition purposes. This magneto is driven off the governor shaft, and is completely under the control of the governor so far as the time of firing is concerned. In the hand control of the governor the time of ignition is also automatically controlled. This arrangement is exceedingly sensitive, an alteration of ⅜ inch of the collar varying the revolutions between 40 and 60 per minute.

The cylinders are water-cooled, the jacket for the same being shrunk on to the walls of the cylinder, and forced lubrication is employed. The exhaust is muffled in a water-jacket silencer, the water employed for this purpose being afterward used in the gas generator.

It is expected that some highly efficient results will be obtained by the application of this plant, particularly for certain types of commercial craft. It constitutes a cheap and efficient source of propelling power, and its development is being followed with great interest. Such a plant has extended possibilities upon tugboats and barges, where weight and space do not form such important considerations.

Engineering Notes.

Stone sawing by wire is done successfully in France, according to a paper by Mr. E. Bourdon in the Bulletin of the Society for the Encouragement of National Industry. A complete plant comprises an endless wire passing round a series of pulleys, one of which is a driving-pulley. The necessary tension is obtained by a straining trolley working on an inclined plane, and between the driving shaft and this trolley is situated the saw frame, which carries the guide-pulleys for the wire saw. This wire, which is driven at a given speed, is caused to press lightly on the stone, and the cutting is done by sand mixed with water, which is conveyed into the saw-cut as the work proceeds. Though the mode of operation appears simple, it entails various difficulties in practical application. Three twisted steel wires are used, each wire having a diameter of 0.098 inch. The strands must be twisted fairly tight and should make one turn in 1.18 inch. The wire may be driven in the workshop at a speed of 23 feet per second, but in quarries or adits the speed should not exceed 13 feet per second. The force exerted by the wire to produce the cut must be uniform and must be capable of being readily varied; moreover, it must be proportionate to the length of the cut.

In the notable passage of the turbine-propelled steamer "Loongana" from Glasgow to Australia, the marine steam turbine once again demonstrated its possibilities and suitability for the same class of work as that which has hitherto been fulfilled by the ordinary reciprocating engines. The journey was covered in 30½ days. The vessel experienced some of the roughest possible weather during the voyage, but even under these most adverse conditions it was found that with four boilers at work a speed of 18 knots per hour could be easily maintained. The average speed, however, throughout was 15 knots, and it was attained on a daily consumption of 63 tons of coal. Some interesting tests were carried out during the voyage to ascertain the relative economies of the turbine and the ordinary reciprocating engines, and conclusive data were obtained showing at what speeds the turbine is the less expensive. These experiments proved that for vessels where a speed of 16 knots is required the turbine is much more economical than the cylindrical engines, but it becomes more expensive if the speed is decreased below 15 knots. Special observations were made of the behavior of the turbines and vessel under fluctuating conditions. On no single occasion was there any sign of propeller racing and it was only when traveling at the highest possible speed that any vibration over the screws was experienced and then it was very slight. Far steadier running was obtained, and even in the roughest weather not a single sea was shipped by the steamer. Not the slightest trouble was experienced with the machinery, and the turbines did not have to be stopped for any purpose throughout the voyage except when coaling at ports. Nor did the necessity arise for repairing or renewing any part of the machinery. This is the longest journey that has ever been covered by a turbine-propelled steamer, and the steady running of the vessel under all conditions of weather constituted one of the most prominent features of the journey. Anticipations have been entertained that although this machinery has proved far more economical in regard to fuel consumption than reciprocating engines for vessels engaged in coast and short-distance traffic, it would prove more expensive for ordinary long-distance voyages. This trip, however, has proved the opposite to be the case and established the superiority of the turbine for long-distance traffic under all conditions.

Occasionally a mine-shaft is "sunk upward," to use a paradoxical expression, for some special reason. The shaft is divided temporarily by brattice-work, the space on one side being filled with excavated rock, and forming a platform for the men.—Engineering and Mining Journal.

Correspondence.

The Weathering of Glass.

To the Editor of the SCIENTIFIC AMERICAN:

In the last number of the SCIENTIFIC AMERICAN I noticed a communication relating to the color which common clear glass takes on when exposed to the air and sunlight. In relation to the same, which I have often noticed, I have formulated the following theory:

The glass is essentially a silicate of calcium with potassium and sodium. The silica used in making the glass always contains some iron, which tends to give to the glass a yellow color. To counteract this yellow color, the glass manufacturers add a small amount of manganese dioxide. This manganese is always present in the cheaper grade of glass in considerable amount, and on long exposure to the air and sunlight forms a permanganate of sodium or potassium, giving the corresponding color to the glass.

The presence of manganese in glass can be easily proven by fusing a small piece with potassium nitrate, with the resulting green color of the manganate of potassium being formed. W. S. LANDIS.

Metallurgical Laboratory, Lehigh University.

The Scientific American Reference Book.

To the Editor of the SCIENTIFIC AMERICAN:

Some days ago it became necessary, in preparing some legal papers, for me to know the exact meaning of certain words, as "ampere," "volt," "ohm," etc., as used in electric lighting. I have in my library the Century and Standard dictionaries, the Britannica and Chambers's encyclopedias. I used them all, and although each defined the words, the definitions were given in such technical language that I or any one else unacquainted with electricity would know no more after reading the definitions than before. I spent an evening trying to find out the meaning of the words, and had just about given up when I happened to see your "Scientific American Reference Book" lying on my table. I looked into that, and there I found just what I had spent hours trying to find, and in such plain language that any person would understand what was meant. I cannot too highly recommend your "Reference Book" to every professional man, and here take the liberty of expressing my appreciation of the same. A. H. VAN BUREN.

Kingston, N. Y., January 28, 1905.

Vestibuled Coaches.

To the Editor of the SCIENTIFIC AMERICAN:

Some months ago an article appeared in your columns entitled "The Menace of the Pullmans," showing the danger to passengers in day coaches, from being crushed by the heavier Pullmans. I called your attention at that time to the progress several roads were making in establishing the heavy, wide-vestibule type of day coach. Recently two striking illustrations have occurred, showing the stability of the modern day coach.

The latter part of January a train on the Boston & Maine Railroad known as the Halifax and St. Johns express, much behind time and running at a high rate of speed, was thrown from the track, by running into a broken rail. All except the engine, baggage car, and one Pullman left the track. One coach was thrown forty feet, another landed on the trunk of an apple tree, breaking it (the trunk) short off as if cut by an ax. The most harm done was the wrenching of the trucks from the body; no one was killed or fatally injured in this wreck.

The other case happened recently on a New York State road by the explosion of a boiler on a west-bound train, which at the moment was passing an east-bound train. The cars were thrown from the track, and yet in the accident no lives were lost except those of the engineer and fireman of the west-bound, who were killed immediately by the explosion. As both of the roads cited used the heavy vestibuled coach, is it not a striking argument for its general adoption? W. M. SNELL.

47 Winter Street, Boston, Mass., February 8, 1905.

Electrolytic Theory of Dissociation.

To the Editor of the SCIENTIFIC AMERICAN:

The following experiment performed in our laboratory may be of interest to your readers as showing an application of the electrolytic theory of dissociation to physiology:

Five dogs of the same breed and about the same size were selected. For two days they were each given the same amount of food, and allowed to drink as much as they wanted. In each case the food was weighed, and the water measured. The excrement was also weighed. They were then given again the same amount of food for the same length of time, but the water supply was diminished thirty per cent. The excrement was again weighed, and in each case was found to weigh less by a very appreciable amount. Less food was, therefore, assimilated when the water supply was diminished.

According to the electrolytic theory of dissociation, solutions of salts in water are dissociated into ions in proportion to their dilution. Since chemical action is a combination of ions, it follows that digestion, which is chemical action, will take place with greater facility in dilute solutions, and, consequently, that within certain limits, the same amount of food will furnish more nourishment in dilute than in concentrated solution. If, therefore, we do not drink enough water, the proportionate amount of food wasted is greater than it should be, and an increased burden is thrown on the organs which take care of the waste. The alarming prevalence of diseases in these organs is probably due largely to this cause. The engineer, to increase the efficiency and economy of his engine, endeavors to get as much power as possible out of his fuel with as little waste. So it should be with the food fuel we take into our bodies. R. E. HIRSCH.

Assistant Professor of Chemistry, Ohio State University.

Columbus, O., January 23.

Disease Dissemination Through Toilet Soaps.

To the Editor of the SCIENTIFIC AMERICAN:

That the upward way to better things is fraught with stumbling and uncertainty goes without saying; but that civilization is responsible for one of the greatest of known hygienic evils, will come as a surprise to the average reader, to whom the subject has never been brought home, and who carelessly exposes himself to infection with no conception of possible danger.

Reference is made to the practice, now so general, of placing toilet soaps in lavatories where different persons have access to and use the same cake of soap.

Whoever thinks of cleansing a cake of soap after use, or considers that filth and disease germs may exist in the discolored ridges and slime upon its surface?

In a public toilet room, soap, reeking with preceding contamination, is used in entire ignorance of the fact that a break in the cuticle will allow infection to be introduced into the circulation as direct and positive as vaccination.

In these days of health boards, and enforcement of ordinances prohibiting expectoration in public places, and the expenditure of large sums for sanitary purposes, it seems strange that this most potent source of disease has received so little public notice.

Contemplation of the actual conditions existing on every hand is appalling, and already this subject is undergoing the agitation which precedes reform. In two Eastern States bills are pending in the State legislatures seeking to make it a misdemeanor to expose toilet soap in public toilets, where it may be handled by different persons. Devices have been invented which obviate this evil by inclosing the cake of soap in such a way as to enable one to obtain sufficient for his use without handling it, and many prominent concerns are already equipped with them; but no reform ever becomes general without public sentiment being first aroused to the danger, and it is hoped that general discussion may lead to correction of this error.

Humanity is confronted with so many ills beyond control, it would seem that one so serious, yet preventable, should disappear as soon as the danger and remedy become fully known.

GEORGE FREDERICK SHAVER.

Some of the Best-Paying Crops.

To the Editor of the SCIENTIFIC AMERICAN:

In looking over some old copies of the SCIENTIFIC AMERICAN SUPPLEMENT recently, the writer was particularly impressed by an article on "Some of the Best-Paying Crops," which appeared in the issue dated July 20, 1901. A proper consideration of the facts given therein affords a very interesting measure of the advances that have been made in planting since that date.

For instance, for a crop of potatoes, in 1901, as the article sets forth, "150 bushels per acre is considered satisfactory to the farmer, which at 75 cents per bushel amounts to $112.50 per acre." Unfortunately, there are yet many farmers who consider 150 bushels "satisfactory," but the best growers now produce 300, and there are men who obtain more than that yield year after year.

Nor is that all to be said about the matter, for it can be shown that even 400 bushels of potatoes is not the limit that can be obtained. From the reports of various agricultural experiment stations, it appears that the Canadian experimental farms, near Ottawa, hold the record in potato production. There the yield on small plots, carefully managed, rose as high as 772 bushels per acre. Seven varieties gave over 600 bushels per acre, fifteen turned out more than 500 bushels, and for sixty-one the crop was 400 bushels or better.

While no such yields have been secured from large fields, it is manifest that the lesser yields in field planting are due to inferior cultivation. Moreover, even with what is called "field cultivation," the best farmers receive from $250 to $300 per acre of potatoes.

In turnips, which was another crop considered, the yield was said to be 400 bushels, usually, per acre. With present-day cultivation a crop of from 500 to 600 bushels is gathered. Where mangles produced 600 bushels, modern methods have turned out more than 50 tons, or say 1,800 bushels.

In field beans the development has been relatively very small, but as cultivated now there are few crops that pay truck growers higher sums for the ground occupied than string or snap beans. For it is a poor variety that will not give a quart of salable pods per foot length of drill, and drills may be made two feet apart. At five cents a quart—a common price—the return should be at the rate of $1,000 an acre, or more.

The yield of parsnips is put down at 500 bushels per acre in 1901, while carrots gave 600. The more careful cultivation now practised has increased the average crop from 10 to 25 per cent, and prices for table varieties are the same—75 cents a bushel. But the records show that a crop of 40 tons of carrots is not beyond reach, and parsnips can be made to yield 30 tons.

A most profitable producer (in certain sections) that was not mentioned by the writer of 1901, is the strawberry. In New Jersey and around Norfolk, Va., a crop of from 5,000 to 8,000 quarts per acre is called good, but there are growers who cultivate extra fine varieties with great care, and thus produce from 10,000 to 15,000 quarts per acre. And the extra fine berries bring from 10 to 15 cents per quart, and in some cases as high as 25 cents, where the ordinary crop brings from 3 to 7 cents.

The methods by which the improved crops are produced are simple and open to all planters. Where the land was plowed and harrowed once before planting, it is now plowed twice and harrowed and worked with a cultivator, perhaps five times, for some crops, before the seed is put in. The use of various legumes for improving the soil has become a regular practice. By the selection of seed and the crossing of varieties, productiveness, and the other good qualities as well, have been greatly improved. As an instance of this improvement, it may be noted that where a crop of 100 bushels of shelled corn was once called good, there is now a record of 238 bushels—all of which increase was due to the crossing of varieties and the selection of seed.

But it appears that the chief factors in the increase of farm crops are formed in the conservation of soil moisture and in irrigation. The dust blanket or mulching of fine earth has often added much more to the size of a crop than any quantity of expensive fertilizers, but a proper system of irrigation to give the required moisture at precisely the right hour is the most important feature of modern scientific farming. It is not too much to say that a proper use of tile drains in combination with a sufficient supply of irrigating water would double the yield of nine-tenths of the farms lying in the regions where it is commonly believed that the rainfall is abundant. For while rains may afford sufficient moisture on the average, it is of the utmost importance that the moisture be applied at precisely the right time.

As the writer of 1901 said, "Every man must decide for himself what crops he can raise with profit." But the day is gone when a man can depend on the experiences of his grandfather in deciding on methods of cultivation. The old-time sneers at "book farming" are seldom heard now, for the men who have accepted the lessons taught by the agricultural experiment stations are the only ones able to answer the question, "What are some of the best-paying crops?"

Northwood, Herkimer Co., N. Y. JOHN R. SPEARS.

The Current Supplement.

The current SUPPLEMENT, No. 1522, opens with an article by Emile Guarini on the viaduct of Fades, which article is splendidly illustrated. "The Spark Coil" is the title of an article which will be read with extreme interest by automobilists. Our Belgian correspondent writes on a liquid rheostat. Sir John Eliot's paper on meteorology in the British Empire is continued. Miss Agnes Clerke, the well-known English astronomer, writes on our solar system. M. Tsybikoff, a Buriat by birth and a Lamaist by religion, was probably the first Occidental who ever entered the forbidden city of Lhasa. A stirring account of his experiences begins in the current SUPPLEMENT. Splendid photographs of Tibetan scenes illustrate the article. Commander W. H. Beehler of the United States navy writes on estimating distances. "Waterproofing Fabrics" is the title of a most instructive technological article by H. Hield. Dr. Allan McLaughlin tells how immigrants are inspected. "The Light of a Glowworm" is interestingly discussed by Dr. T. Lamb Phipson. The usual electrical notes, science notes, and engineering notes are published.

EDUCATION OF BOYS BY THE MILITARY METHOD.

BY MAJOR R. L. GIGNILLIAT.

The Culver Military Academy has been especially fortunate in that the generosity of its founder, the late Mr. H. H. Culver, of St. Louis, and the continued munificence of his widow and sons, have enabled it to include in its equipment, without regard to expense, all those military features which are most apt to appeal to a boy's interest and in the learning of which he is most apt to acquire a good physique, nerve, alertness, good judgment, and all those other qualities that will make of him an effective, capable man.

The cavalry department doubtless stands pre-eminent among these special provisions. The building of a large, well-equipped riding hall, and the purchase of a troop of forty suitable horses, involved no little outlay at the start and is an item of considerable expense in maintenance, but that it pays big dividends in the making of fine physiques and in the development of patience, perseverance, and grit, there can be no doubt. The American boy has a natural liking for the horse, and a natural aptitude for riding, and when there is added to this the glamor of the cavalry features, it becomes irresistible indeed. The cadets of the Culver Black Horse Troop have acquired a reputation for their horsemanship that is not altogether undeserved, for in their rough riding they perform many feats of horsemanship that a professional performer need not be ashamed of. This is all the more remarkable, in that many of these youngsters got on a horse for the first time when they joined the troop. Natural aptitude plus keen interest and proper instruction works remarkable results.

The history of the buying of the troop tends also to add somewhat to its *esprit de corps*. The first horses of the troop were those that proudly paraded Pennsylvania Avenue at President McKinley's first inauguration, as the mounts of his personal escort. They were bought from Troop "A" immediately on their return from Washington. A tradition of the old Troop "A" is still retained in the naming of the horses, the name of each beginning with the initial letter of the troop. There are Agility, Aguinaldo, Airy, Ace of Spades, and forty-five others, and in the last stall Amen. The cadets learn to ride as do the troopers of the regular cavalry, without saddle, the horse equipped with a watering bridle, blanket, and surcingle. They start out awkwardly enough, clambering laboriously to their horses, and sitting them like the proverbial sack of meal. In a few months, however, they spring lightly from the ground at the word of command, and land clearly on the horse's back. They do this at the trot and at the gallop, and vary it by mounting to a standing position, or by turning in air so as to land facing the croup, or perhaps vault entirely over the galloping horse, and then mount from the off side. They ride standing and take hurdles while in this position; some of the more expert even stand facing to the rear. Then, not content with the feats of the cavalryman's "monkey riding," they link three, sometimes even four, horses together, and, spanning the inner horses Colossus of Rhodes fashion, go dashing about the hall, taking hurdles, dismounting, mounting, and vaulting in true Græco-Roman style. It is indeed an inspiring sight to see these youngsters performing these feats of horsemanship of the ancient hippodrome standing on their flying horses as lightly as a mosquito hawk on a swaying reed, the embodiment of youthful daring and youthful grace. And what training it is indeed for eye, nerve, and muscle! The Græco-Roman picture shown in this article was the model used by Zolnay for a life-size bronze statue that was placed on exhibition in the east entrance of the Palace of Education at the St. Louis Fair. It attracted much attention by its spirited appearance, and was awarded a medal.

The less spectacular but more practical cavalry features also receive their share of attention. The troop is drilled in the saddle, and the cadets are taught the use of the saber, the carbine, and the pistol. On holidays they frequently make long road marches, with halt for lunch and the interesting details of a picket line and a camp fire. Possibly during the march they ford a stream; their carbines pulled from the boots are carried on the shoulder to keep them dry, and the rider's legs are stretched along the horse's neck, to keep them out of the water and to guide the horse.

The government furnishes modern breech-loading field pieces for artillery drill, and this instruction is given to cadets in the upper classes. They are taught how to load and to fire the piece, using blank cartridges. At Culver some of the black horses are then drafted into service, and the cadets are taught the mounted drill with all its dash and excitement. Cadets who have been well trained in the cavalry department are mounted as drivers, and it is indeed an interesting sight to see them cracking their long black whips and expertly guiding their teams as they gallop through the movements of "Action Front!" and "Action Rear!" and the other evolutions of the drill.

The Gatling-gun drill too has its element of interest, and the cadets have established a record for making a hundred yard run and going into action in 26 seconds. This was done in an exhibition the cadets gave on Culver Day at the St. Louis Exposition.

A record of constructing a rope and spar bridge, 26-foot span, complete to the tying of the last knot, in 4½ minutes, is a record of which the cadets in the bridge-building detachment also feel proud. An important feature of their military training, and one in which the cadets also take a great deal of interest, is their rifle practice on the range. They shoot at two, three, and five hundred yards, and some very creditable scores have been made. Marksmen's and sharpshooters' badges are given the cadets under the same qualifications as those prescribed for the National Guard. A soldier should be taught not only how to shoot straight, but how to protect himself under fire, and this also figures in the cadet's instruction. He is taught how to dig shelter trenches for the three positions—lying down, kneeling, and standing.

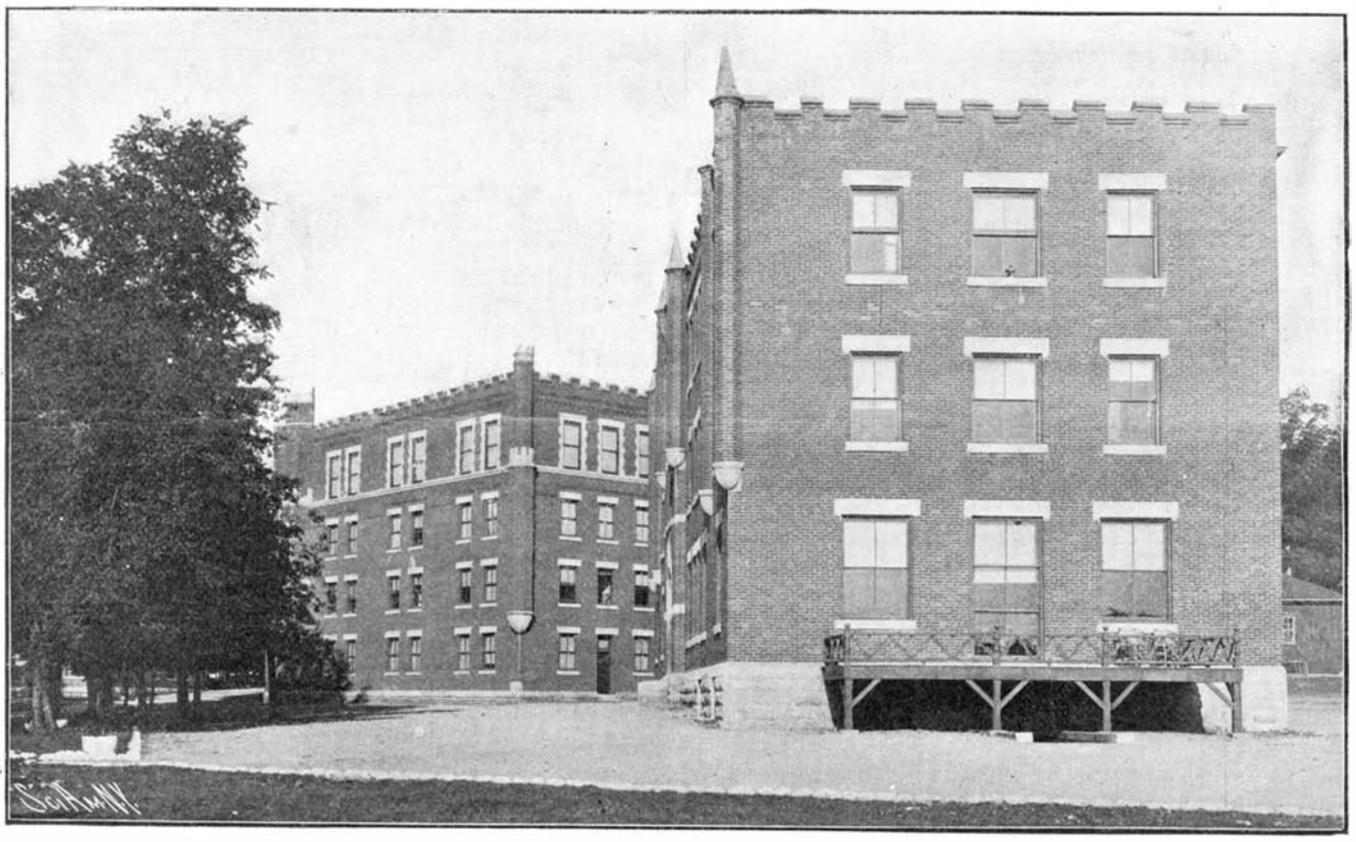
The infantry drill, however, is in a way the most important of all the military instruction. The battalion of infantry is in all military schools the basis of the organization for both military instruction and discipline. The manual of arms and the close-order drill, with their machine-like precision, are wonderfully effective in teaching a boy a regard for details. Then there are the extended-order movements, with skirmishes over the surrounding country and attacks with blank cartridges on an imaginary or represented enemy. These are what the cadets enjoy most of all.

When the weather permits there is parade at sunset. The cadets, drawn up in a long, motionless line, made resplendent by glittering brasses and snowy-white cross belts, stand at parade rest while the band "sounds off." Then the evening gun is fired, the battalion is called to attention, and while the band plays the "Star-Spangled Banner," the national flag is impressively lowered. This is a ceremony that never loses in effectiveness by being repeated, and one that is calculated to arouse a boy's patriotism if anything will.

There are other details of the cadet's military training besides these matters of the practical drill. There is the marching to meals and to classes, company inspections to see that all linen is clean, clothing brushed, and shoes polished; room inspections, where the officer passes a white-gloved hand over the furniture, and many other things that cannot be mentioned here. And lest the impression should be gained from this description of a cadet's military instruction that he does naught else save drill and perform military duties, let it be said that he does quite as much studying as the student of the non-military school, and does it with clearer head by reason of his regular hours and abundant exercise.

There is an hour or so of recreation that figures in his day's routine also, and what it lacks in length is compensated for by the extra zest that is lent to it by the close attention to duty during the rest of the day. The cadet finds time also to distinguish himself in athletics. As a matter of fact, the military instruction by its enforced system might almost be said to create the time it uses, and it in this way trenches in no way on the time for the other important things of a boy's education.

All that has been said so far has been with reference to the military instruction as a means of teaching boys to become effective citizens. The government, however, regards this military instruction as an end in itself, for it appreciates the value to a nation dependent largely on its citizen soldiery in time of war, of having so many of its youth each year well trained in the soldier's calling. The government, therefore, encourages this military instruction in schools by detailing officers of the regular army to a certain number of colleges and military academies in each State, and by issuing to these schools rifles and equipment and a liberal yearly allowance of ammunition. The institutions to which officers are thus detailed are divided into three classes, A, B, and C, according to the extent of the military instruction they give to students. Class C comprises those which devote the most time to the military instruction, and regulate the cadet's daily duties by the same sort of routine in force in a military garrison. It is the instruction given in schools of this class that it has been the intent of this article to describe.

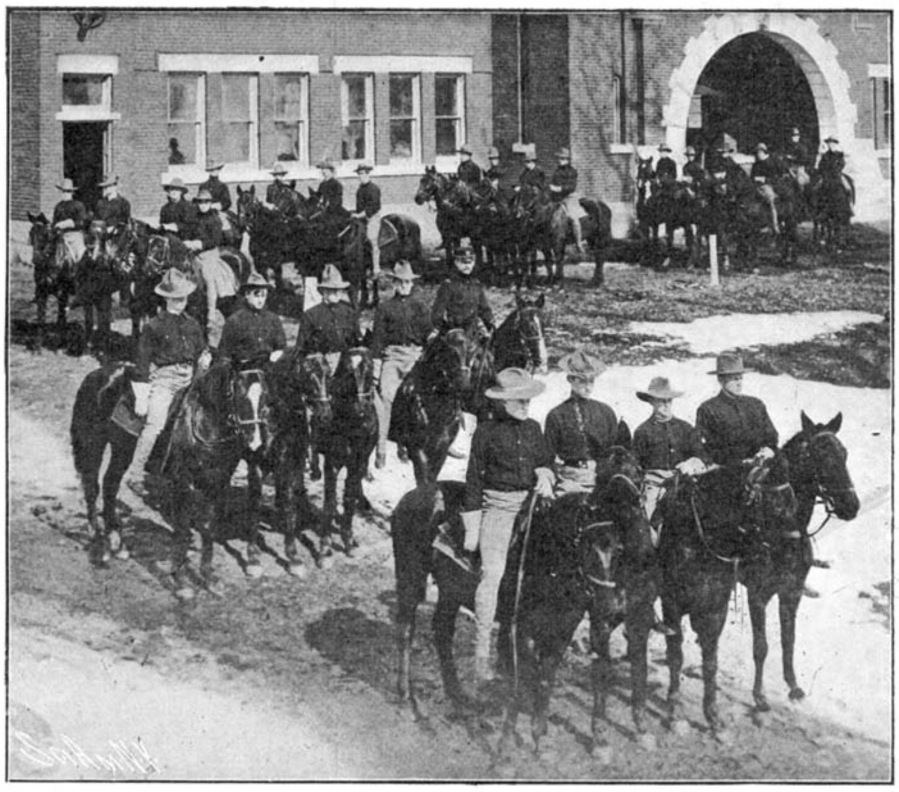


One of the Fireproof Military Barracks.

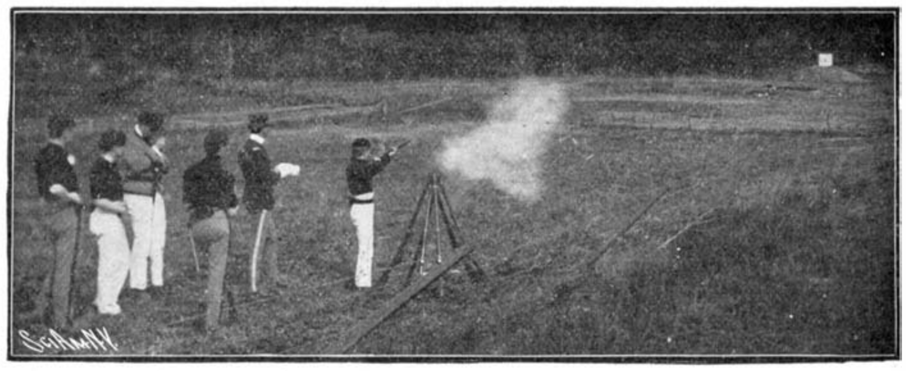
EDUCATION OF BOYS BY THE MILITARY METHOD.

Makes the Water Pump Itself.

A current motor conceived with reference to its use in connection with irrigation has recently been patented, and is now being introduced throughout the Western States. The mechanical principles upon which it is constructed are those of deflection and leverage, which until now have never been combined for purpose intended. The current pressing against a sheet-iron blade resting in the stream and placed at an angle to the current, causes the blade to swing back and forth. The force generated is communicated through a lever back to pumping mechanism or other machinery. After lever has reached the limits of its sweep, the blade is forced automatically to a reverse angle to that formerly occupied, which causes the blade and lever to travel in an opposite direction until limit is again reached, this performance continuing without introduction of any other power than that furnished by the stream and without any attendance or supervision. The lever or sweep is hinged to supporting timbers, so as to make the motor self-adjustable to any stage of water. All parts are above water, thereby making it an easy task to oil and keep in repair. The expense is confined to first cost of plant and installation, and the absence of any cost incidental to operation and maintenance makes it the cheapest known irrigating device, and by reason of this fact it will doubtless appeal to those interested. The inventor of this motor is Mr. John Roeh, of Spokane, Wash., corner Riverside and Post Streets.

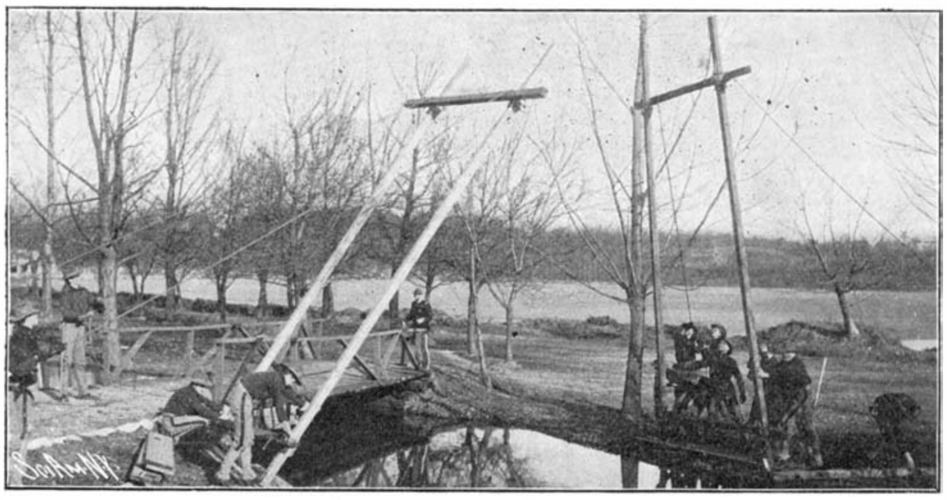


Cadets Leaving the Riding Hall.



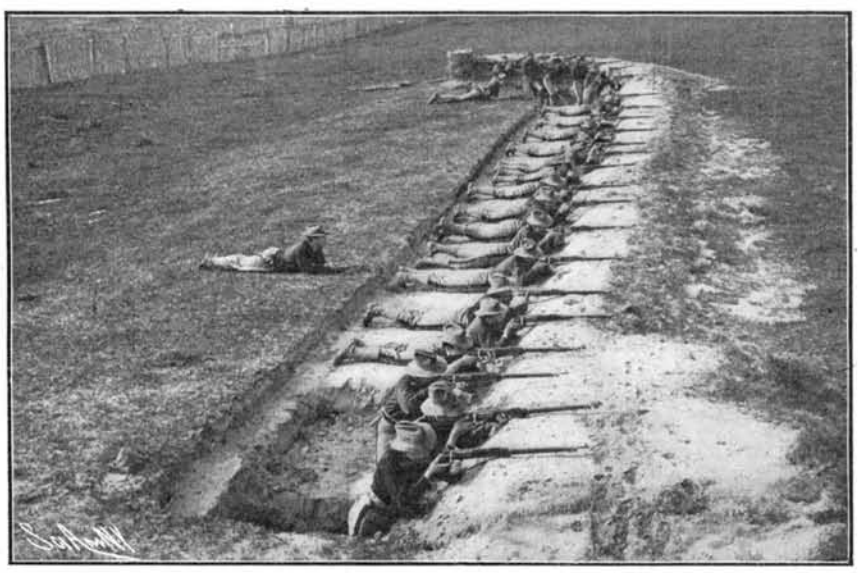
On the Target Range at 200 Yards.

The Gatling-Gun Drill.

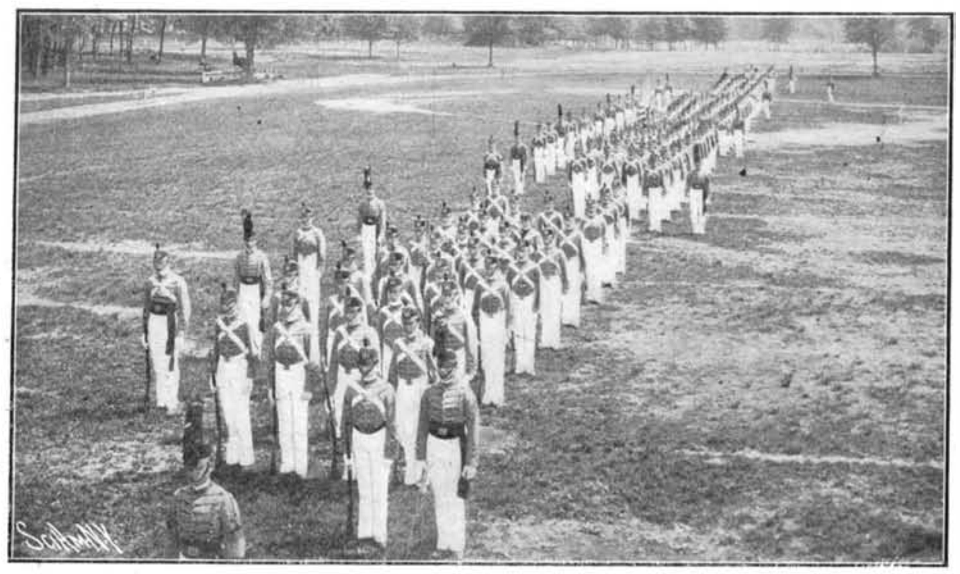


Bridge-Building Drill. The Cadets Have Built a Bridge in 4½ Minutes.

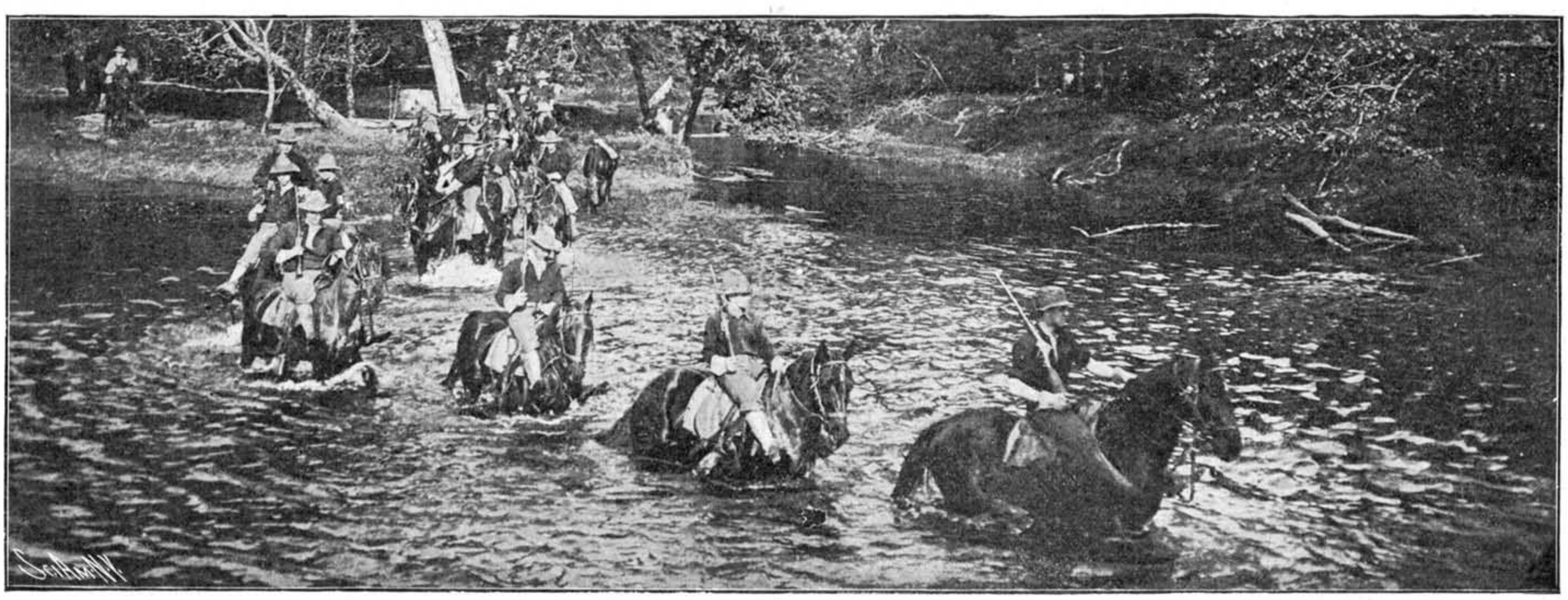
Græco-Roman Riding.



Hasty Intrenchments. Lying Down, Kneeling, and Standing.



Full-Dress Drill. The Formation is a Column of Squares.



The Black Horse Troop. Carbines Are Taken From the Boots and the Legs Extended to Keep Them Dry, and Also to Guide the Horse Into Deep Water.

EDUCATION OF BOYS BY THE MILITARY METHOD.

A NOVEL MOTOR ICE BOAT.

The motor ice boat shown in the accompanying illustration was built by Mr. Charles S. Ketcham, of Eastport, L. I. The boat consists of an ordinary scow having mounted within it a two-cycle gasoline motor of four or five horse-power, which is connected direct by a belt to a large spiked wheel mounted forward of the motor, and adapted to engage the ice through a slot in the floor of the scow. The motor scow is steered with a sharpened steel rudder blade on the end of a long sweep. This motor ice boat is a very simple affair that can be constructed by any amateur, and yet it is capable of attaining a considerable speed and giving much enjoyment to the owner.

A HOME-MADE MOTOR ICE BOAT.

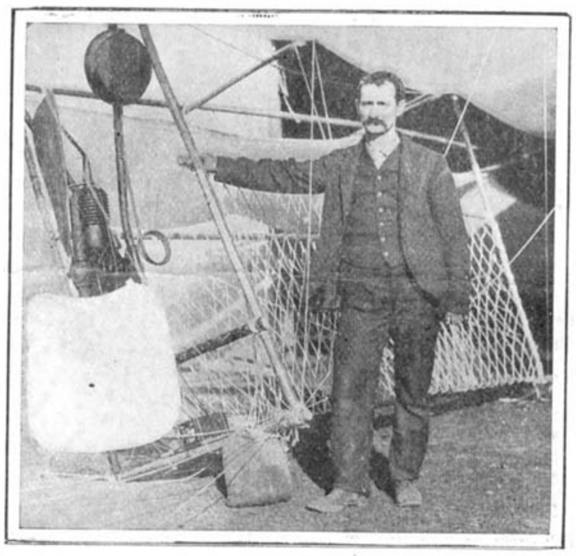
THE HEATON AIRSHIP.

Since the publication of our article last week in which the failure of Heaton's airship, the "California Messenger," was chronicled, we have received the two pictures herewith published. They show admirably the construction of the craft, and indicate that it differs not very widely from most gasbag dirigible balloons. To recapitulate the information published last week, it may be stated that the Heaton airship consists first of a silk gas reservoir 76 feet long and 14 feet in diameter, with a capacity of 10,000 cubic feet of hydrogen gas, of a lifting power of 600 pounds. Directly beneath the bag is a sheet of canvas, denominated by the inventor an "aeroplane," designed to assist the movement of the airship in falling or ascending. The rudder is lightly constructed of bamboo covered with sacking, and is governed by ropes at the will of the engineer, the air current, generated by the rapid revolution of engine and propeller, assisting in the prompt control of the airship in the line of direction as the operator determines. The platform upon which the operator stands is built of bamboo rods trussed to the net above by linen lines.

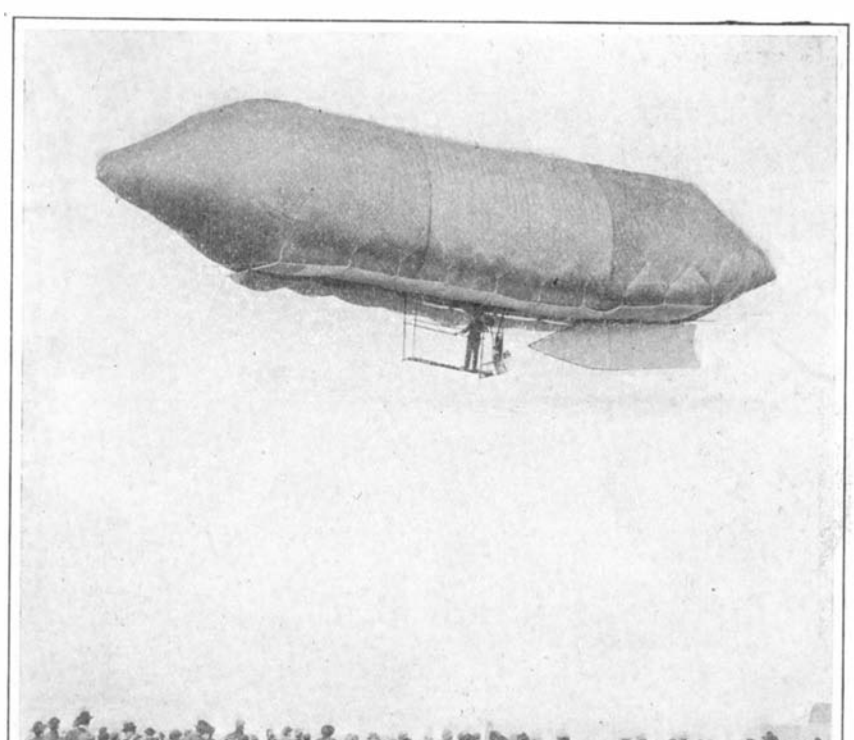
The engine, though generating 20 horse-power, weighs, exclusive of propeller, but 55 pounds. It is described as a double-cylinder, 4 by 4, revolving around a stationary crankshaft, the propeller blades being attached to and a part of said cylinders. It is constructed of steel, and the motive power is furnished by gasoline. Power is increased by the elimination of flywheels, as well as lightness by dispensing with water coolers, the cylinders being kept cool by the strong air currents generated by the rapid motion in revolving. The two fans have each a surface of 8 square feet and are 5 feet from tip to tip.

In common with other affairs of life, some of the most simple and apparently obvious facts of steam engineering have only been learned after long experience and endeavor in a contrary direction to natural laws. Years ago, before the days of the distillers on board ship for supplying fresh water to the boilers, it was the practice in the United States Navy to use salt water for the "make-up," i.e., to supply the water lost by leakage and other wastes. The rule was never to allow the salinity of the boiler water to exceed 1½ per cent of saturation. But, of course, it happened more than once that this rule had to be broken on account of leaky boilers, stress of weather or other reasons which make it impossible or unsafe to blow off and replace with sea water. Under such circumstances the surprising result was always noted that the scale deposits were more friable and easily broken loose from the sheets and tubes, so that cleaning the boilers was an easier task than when the salinity had been kept down to the prescribed percentage. The reason, of course, was that when the salinity was kept at a low percentage more sea water had to be pumped into the boilers, which introduced more lime and other scale-making properties. The lime being thrown down at once, formed a hard insoluble scale that could be removed only with difficulty. With less seawater introduced less lime was deposited, hence less scale.—Machinery.

There were six mines in the United States which produced over 1,000,000 tons of ore each in the year 1903. Five of these—the Fayal, the Mountain Iron, the Adams, the Stevenson, and the Mahoning—are on the Mesabi range, in Minnesota; the sixth is the Red Mountain group, in Alabama. Eleven other mines shipped over 500,000 tons and less than 1,000,000 tons each. These were the Biwabik, the Spruce, and the Burt, on the Mesabi range; the Pioneer and the Chandler, on the Vermilion range, in Minnesota; the Chapin, the Cleveland Cliffs, and the Pewabic, on the Menominee range in Michigan; the Aragon and the Lake Superior, on the Marquette range; and the Norrie, on the Gogebic range.



Heaton Standing Next to the Frame of His Airship.



THE HEATON AIRSHIP IN FLIGHT.

MOTOR BOAT ENGINES AT THE SPORTSMEN'S SHOW.

At the eleventh annual Sportsmen's Show, now being held in Madison Square Garden, New York, the exhibit of motor boats and their engines, together with a large oval display tank in which the boats are shown in action, occupies the entire main floor. Although there is no great change in the construction of the boats themselves, there is a decided increase in the size of the gasoline engines used on some of the larger ones for the purpose of developing high speed, and the number of cylinders used is as high as six or eight.

The accompanying illustrations show several of the noteworthy engines on exhibition. The 250-horse-power, eight-cylinder Craig engine used in the "Onontio" when she made her record nautical mile in 2 minutes, 26 seconds (28.42 statute miles per hour) last October is the largest engine at the show. The large inlet and exhaust pipes used on this engine are noticeable in the photograph. They are 3 and 4 inches in diameter respectively.

The cylinders have a 7¾-inch bore and a 9-inch stroke, and their heads contain twin inlet and exhaust valves mechanically operated by bell cranks worked from a single cam shaft on one side. The compression used is 80 pounds, and the speed of the engine 850 R. P. M. A three-bladed, reversible propeller was used with it on the "Onontio." The cylinders are mounted on nickel-steel stanchions, the cranks being entirely exposed. The bearings and cranks are lubricated by wick oilers. The crankshafts, of which there are two coupled together at the center, are 2⅞ inches in diameter. They are of nickel-steel, hollow-bored. The bedplate, bell cranks that operate the valves, and a number of other smaller parts are made of manganese bronze.

The total weight of the engine is 3,520 pounds. Variable make-and-break igniters are used on this engine, the current being supplied by two magnetos driven by bevel gears. The two four-cylinder engines of which it is composed are thus independent even to their ignition current supply. Separate carbureters supply each also.

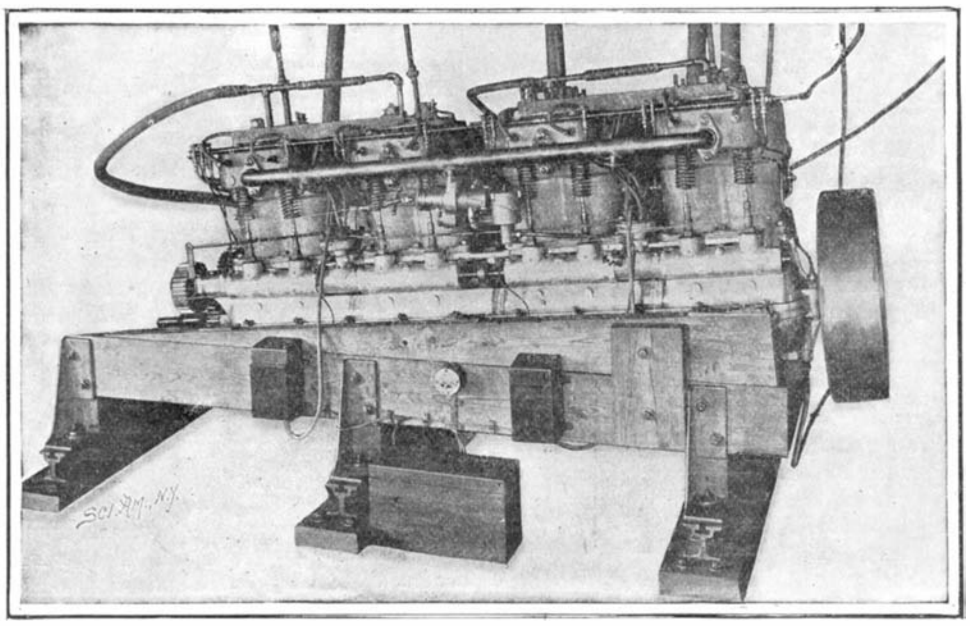
Another engine built on somewhat the same lines as the Craig is the new 100-horse-power, six-cylinder Standard, which has 8 x 10 cylinders and develops its power at 300 R. P. M. This engine has its valves in a valve chamber beside the cylinder. The inlet valve is automatic, or suction-operated, and is provided with a small piston on its valve stem. This piston (which is fitted with one piston ring) works in a closed cylinder having but two or three small air holes, through which the air can escape. Thus it forms an air dash pot and keeps the valve from seating too heavily.

An extra set of cams permits of running backward. Three of the cylinders are fitted with auxiliary valves for letting in compressed air for starting and reversing purposes. A special cam opens the exhaust valve during every up-stroke of the pistons, and air is admitted during every down-stroke, so that the three cylinders form a single-acting compressed-air motor under those conditions. As soon as the other three cylinders begin to fire, the air is shut off and the whole engine is run on gasoline. Sufficient air is carried, at a pressure of 75 to 100 pounds per square inch, to run the engine two or three minutes this way alone. The air is compressed by an air pump driven by an eccentric on the crankshaft. The starting and reversing feature makes a clutch and reverse gear unnecessary, as the engine can be started and reversed under load.

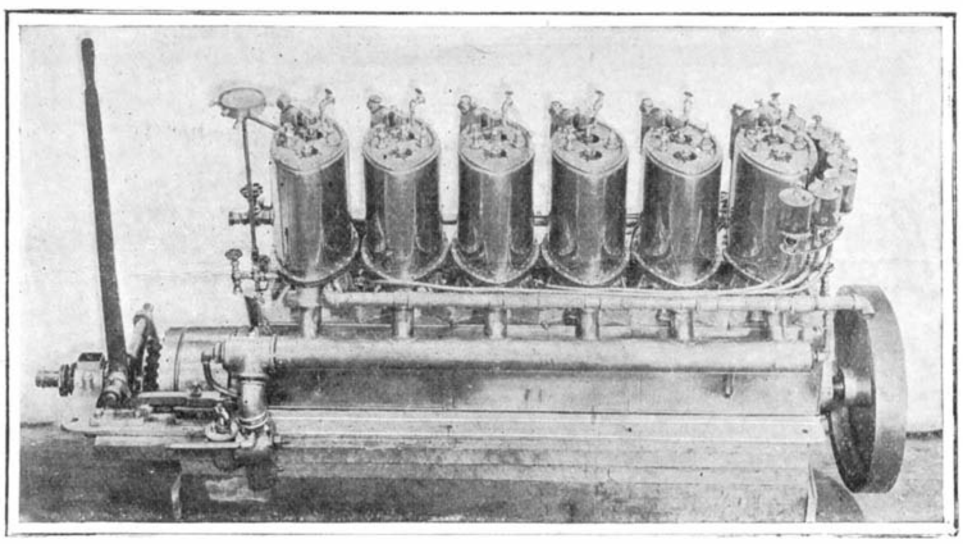
The 150-horse-power Simplex engine of the "Challenger," which boat covered a mile recently in Florida at the rate of 29½ miles an hour, consists of eight cylinders cast in pairs and bolted to a single aluminium crank case. The crankshaft is a steel forging of generous size. The bore and stroke of the cylinders are 6½ and 6¾ inches respectively, and the compression used is 95 pounds. The motor develops its full power at 800 R. P. M. It is fitted with jump spark ignition from

storage batteries and two spark coils, the secondary current being distributed to the various spark plugs by means of two high-tension distributers. The oil is kept at a certain level in the eight compartments of the crank case by means of a special oil pump. A small scoop on each crankpin box dips into the oil and raises a small quantity of oil at every revolution, pouring it into a trough in the upper part of the case, which directs it to the bearings. The sight-feed oilers at the top of the engine also oil the bearings and cylinders. A single automatic carbureter supplies all eight cylinders. In this carbureter the main air passage is very small, and the auxiliary air enters through specially-shaped passages determined by experiment and so shaped that the rate of admission of the air varies with the speed of the motor. The motor has all the improvements suggested by a large automobile experience, such as the ends of the exhaust-valve springs being passed through holes in the valve stems instead of being secured by a washer and pin, for example. It is set at an angle of 5 deg. in a boat, but the special oiling system assures a liberal supply of oil to all bearings, without too much oil at the lower end and consequent fouling of the spark plugs.

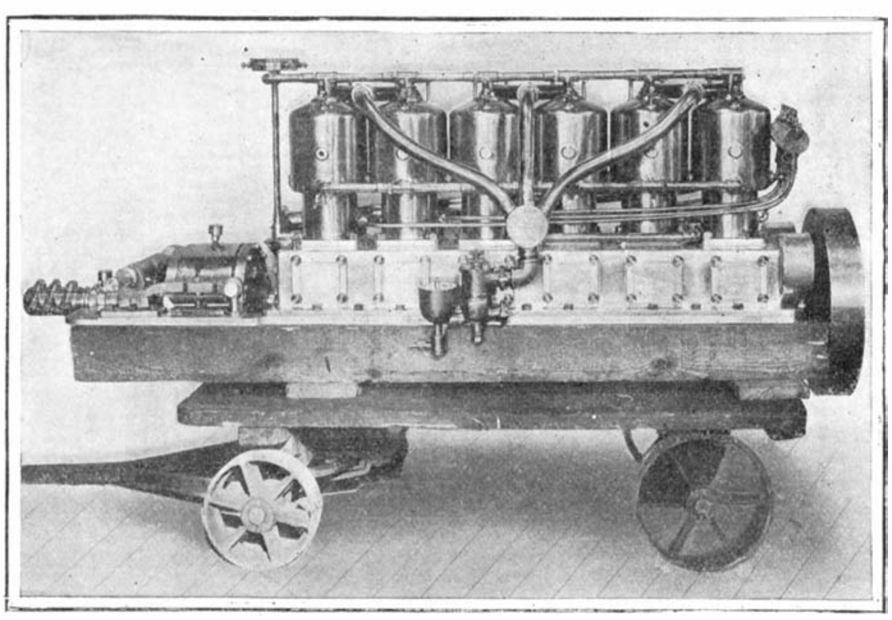
The two six-cylinder engines shown by the Gas Engine and Power Company, of this city, were two of the finest and best-finished engines at the show. This company's product, both motor boats and automobiles, is sold under the name "Speedway." Two types of four-cycle motors, besides several small two-cycle engines, are manufactured by it. The most interesting engine on exhibition is the six-cylinder four-cycle motor with elliptical brass water jackets. The inlet and exhaust pipes pass up within the jackets, and the only pipe or piece of machinery exposed besides the cylinder is the rod that operates the rocker on top for opening the exhaust valve. The inlet valves are automatic, and, with the exhaust valves and spark plugs, are located in the head. The contact maker is on a vertical shaft at the rear end of the motor. Individual spark coils with tremblers are used. The cylinders are mounted upon steel stanchions instead of on the crank case. The bore and stroke are both 6 inches, and the motor develops 60 horse-power at 900 R. P. M. The other four-cylinder motor is of the standard automobile type, with individual, integrally-cast cylinders bolted to the crank case. with mechanically-operated inlet and exhaust valves, single carbureter, jump-spark ignition, etc. It has a 4½-inch bore by 5-inch stroke and develops 42 horse-power at 900 R. P. M. The company also builds a 7-horse-power two-cylinder, a 10½ and a 21-horse-power three-cylinder, and a 14, 28, and 60-horse-power four-cylinder motor of this type, as well as a 90-horse-power six-cylinder. A 3-horse-power single-cylinder and a 6-horse-power double-cylinder two-cycle engine are also manufactured.



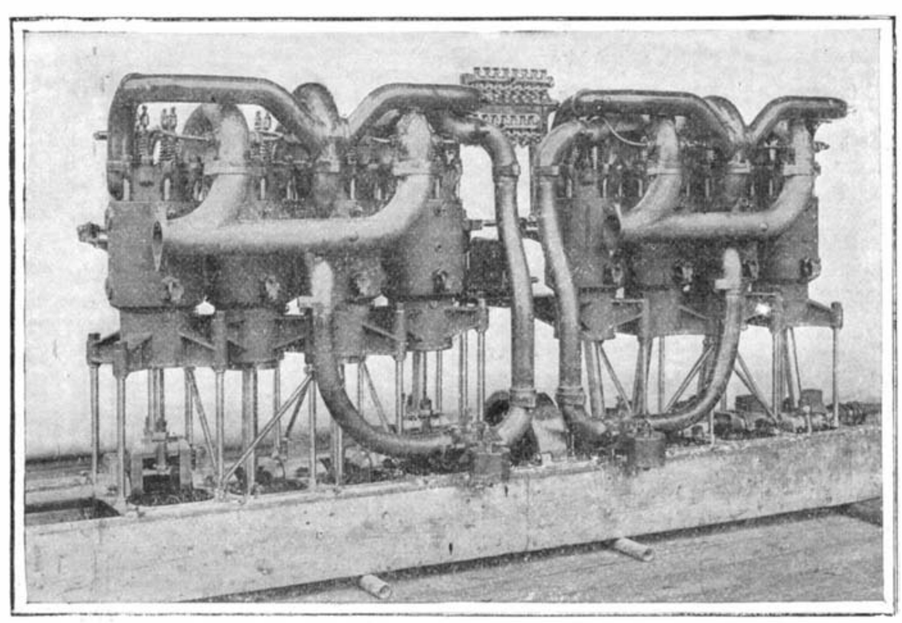
The 150 H. P. Engine of the "Challenger."



60 H. P. "Speedway" Motor Boat Engine Fitted With Brass Water Jackets.



42 H. P. "Speedway" Engine, Showing Carbureter and Reverse Gear.



250 H. P. Craig Marine Engine, Which Made a Record Mile in the "Onontio."

MOTOR BOAT ENGINES AT THE SPORTSMEN'S SHOW.

One of the novel motor boats on exhibition was shown by the Electric Launch Company, of Bayonne, N. J. The motor of this boat was placed forward of the cockpit in the bow of the boat, and the cockpit contained four small seats with aluminium backs, such as are seen on automobile racers. The steersman is intended to sit directly back of the motor, and the whole layout is much the same as on an automobile. The Panhard boat was constructed on similar lines, although the motor in this instance was not placed so far forward. This design does not appear to be as good as the usual one, in which the motor is placed in the center of the boat; for with the motor in the bow, the boat is liable to be topheavy in a seaway, and the motor also is difficult to get at for adjustments.

The Standard Company also exhibited a novel electric lighting and refrigerating plant for yachts, consisting of a 5-horse-power, single-cylinder gasoline engine combined with an air-compressing cylinder on one side and a jacketed air-expanding cylinder on the other, the three-throw crankshaft being direct-connected to a 2-kilowatt dynamo. The air, compressed in one cylinder to 75 pounds to the square inch, is sent through a system of cooling coils and then expanded in the expansion cylinder, which reduces its temperature to about 15 degrees below zero, while consuming only a small fraction of a horse-power in the transformation. The cold air is discharged into a refrigerating tank, which, if of 100 cub. feet capacity, will be kept at a temperature of 16 degrees. If desired, vessels of water placed in this tank can be frozen, in order to keep the tank cool while the plant is not running. This plant is an accessory that will be found very convenient by yachtsmen.

Raisins.

Soak some raisins in water and examine them. Within the thin skin is a soft pulp, in which several small seeds lie. The fruit appears to be one-celled, but when quite young was two-celled, the dividing wall disappearing as the fruit ripened, and forming part of the pulp. It is superior, no trace of a calyx being discernible at its apex, and may be classed as a berry, although the berry is usually inferior. The pulp has a sweet, slightly acidulated taste, but the small, hard, pear-shaped pips are astringent, as is also the skin.

Raisins are the dried fruit of the grape-vine, and are produced chiefly in Spain, although vines are cultivated in many other countries (Italy, California, Australia, Greece, etc.). They are usually partially dried on the vines, the stalk being twisted or broken to prevent moisture from reaching them, and the drying completed in a warm room. They are packed for exportation either in bunches (muscatel raisins from Malaga) or loose (Valencia raisins). Sultanas are a small, seedless variety of grape, exported from Smyrna, and currants a still smaller variety, exported from the islands of the Grecian Archipelago.

Raisins are slightly laxative in their action, as, indeed, most fruits are that contain abundance of sugar. They contain about 25 per cent of water, 65 per cent of sugar (dextrose and levulose), and 1.4 per cent of acid, chiefly present as potassium bitartrate. If kept for a long time the water evaporates, and crystalline nodules of sugar or potassium bitartrate make their appearance.—Pharmaceutical Journal.

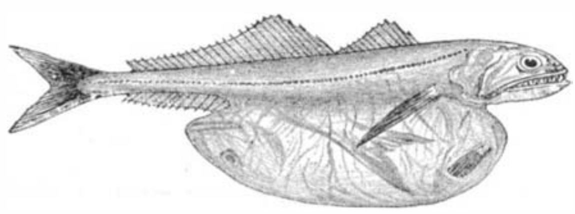
A huge project for the perfection of the drainage system of the city of London is being prepared. This undertaking has become necessary owing to the fact that the metropolis is increasing in size at the rate of 1,000 houses per month, and the existing facilities are not sufficient to cope with the requirements. This new scheme involves the construction of 300 miles of main and flood sewers. At the present time London is not provided with two systems of drainage—one for houses and the other for streets. The result is that when there is an abnormal rainfall, floodings invariably follow, and the contents of the buildings are considerably damaged thereby. It is anticipated that the new scheme will occupy from four to five years to carry out, at an expenditure of $35,000,000. The underground works will cost $15,000,000, and when the enterprise is complete, London will be one of the healthiest cities.

CURIOUS FISHES OF THE DEEP SEA.

BY DR. SANDERSON CHRISTISON.

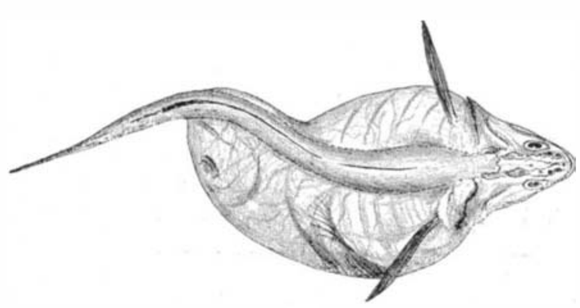
That one animal can devour another twice its own size, at a single swallow, is a statement that may seem to the uninformed to be as incredible as any fish story ever invented. Nevertheless, it is true of certain fishes. So far as known, such fishes are inhabitants of the deep seas, where utter darkness perpetually prevails, with an unvarying temperature almost as cold as ice, and a pressure ranging, according to depth, from a quarter to three or four tons upon every square inch of their body surface.

The deep sea is commonly regarded as commencing where the rays of sunlight cease to penetrate, which is estimated to be less than twelve hundred feet below the surface, and may extend to twenty times that distance, or even much more, down to the bottom of the ocean. Fishes have been dredged from below twelve thousand feet. Under such diverse conditions of life, we would naturally expect that their respective inhabitants would present considerable difference in their structural particulars, and also in their habits. To a considerable extent such is the case. But in this connection we meet with some surprises of quite a remarkable character, and which seem to oppose the current evolution theory. For example, instead of the total darkness invariably abolishing the organs of vision by disuse, we find that the deep-sea fishes commonly possess eyes, while only a few are blind. In this connection it may be remarked that some surface-water inhabitants are also blind. There are evidences, however, which appear to be characteristic qualities of deep-sea fishes, namely, weak connective tissue and extremely delicate fin muscles, indicating still-water conditions; also thin fibrous bones, full of cavities, indicating high-pressure conditions. While these peculiarities are doubtless well adapted for deep-sea life, an idea of their unfitness for superficial waters may be gleaned from the following extract from Dr. Alcock's recent book, which records his observations as naturalist to



CHASMODON NIGER (CARTER).

Fish 6⅝ inches long containing in its stomach a fish 10½ inches long.



CHASMODON NIGER (CARTER).

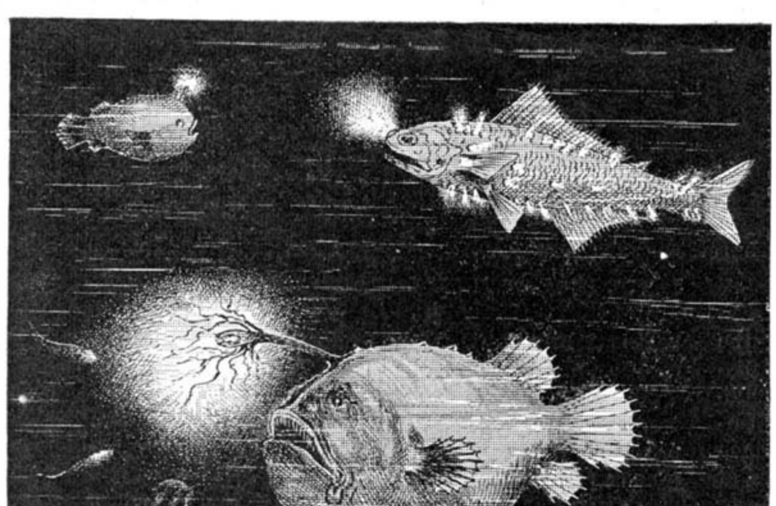
Top view of 6⅝-inch fish with 10½-inch fish in its stomach.

the ship "Investigator" of the British navy. He says: "When a deep-sea fish is brought to the surface, how gradually and carefully soever, its bones are often like so much touchwood and its muscles like rotten pulp, while its eyes are burst from its sockets, and its viscera are often blown out of the body cavity by the expansion of the air bladder." It frequently happens that deep-sea fishes are found floating helplessly on the surface of the ocean, with large prey in their stomachs. Their appearance under these circumstances is accounted for by the efforts of their struggling victims to escape from their jaws, causing them to ascend beyond the horizontal zone which they usually inhabit. "This explains," observes Gunther, "the fact that all the specimens known of *Saccopharynx* and *Melanocetus*—deep-sea fishes with the same extensile stomach as *Chiasmodus*—were found with large fishes in their stomachs. The specimens swallowed were found in each case to be in a very early state of digestion."

Yet, in a general way, the structural forms of deep-sea fishes are identical with certain fishes familiar to surface waters, so that they are regarded as simply being adaptations of existing surface-water species, and not a special order by themselves.

It appears that many surface-water species stray into the deep seas; and while the shift from the one environment to the other is necessarily through a graded course, it is a mystery why any should ever have remained under such unfavorable conditions.

1.—Paroneirodes glomerosus. 2.—Notoscopelus resplendens.

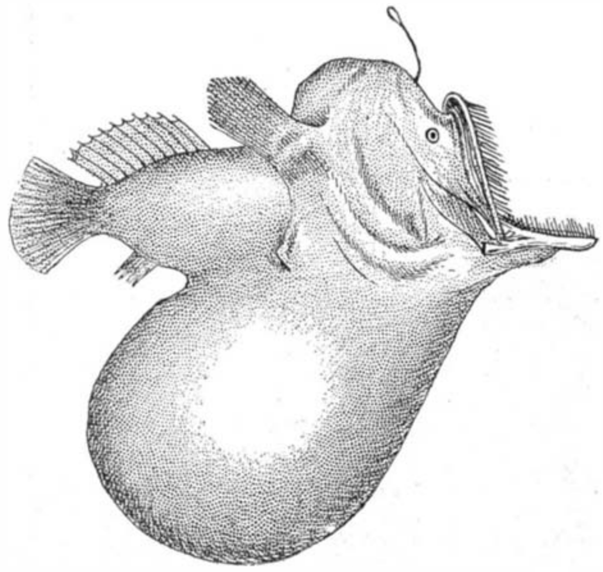


3.—Corynolophus Reinhardti.

SOME PHOSPHORESCENT FISHES OF THE DEEP SEA.

Such a naturalization would seem to be a reversal of the most natural kind of selection, and there appears to be no theory to account for it.

In addition to the extraordinary rapaciousness of certain deep-sea fishes, there are many which are re-



LIOCETUS MURRAYI (GUNTHER).

A fish less than 4 inches long with a fish in its stomach 7½ inches long.

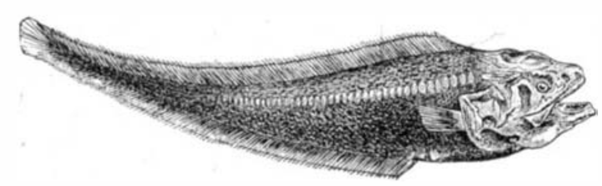
markable for their possession of illuminating organs. These attributes are not limited to deep-sea fishes, but among these fishes there are examples which eclipse anything elsewhere found. With the exception of the so-called "lures" of deep-sea fishes, their luminous organs appear to be modified mucous glands, which produce the "phosphorescent" light. These are said not to exist in the small-eyed fishes, which, instead, possess sensitive organs of touch; and while they are commonly absent in the blind fishes, some possess them highly developed, as in the *Benthobates moresbyi*. But illuminating power may exist without phosphorescent glands. For example, in the *Leptoderma affinis*, which has eyes resembling goggles, there are no phosphorescent glands, but its skin gives off a luminous bloom. In the *Ipnops*, the two eyes are flattened out, covering the whole top of the head, and are luminous in life. In the *Orthoprora*, the luminous body covers the end of the nose, like the headlight of an engine. The deep-sea "angler" or "sea-devil" has a rod-like barbel rising from its head and ending in luminous filaments, which are supposed to act as lures for other fishes. According to Gunther, fishes have frequently been taken from the stomach of the "angler" quite as large as itself. It is commonly from three to six feet long.

The little *Melanocetus*, which is illustrated here, is not quite four inches long, but contains in its stomach a fish seven and a half inches long, rolled up spirally into a ball. This fish is also remarkable for having a vertical mouth. According to Gunther, three specimens of the *Saccopharynx* (a deep-sea eel several feet long) were found floating with fishes in their stomachs which many times exceeded the length of their destroyers. The *Plagyodus ferox* is about six feet long and very ferocious. From the stomach of one were taken several octopods, crustaceans, a young brama, twelve young boar fishes, a horse mackerel, and one young of its own species. One peculiarity is that it has ribs symmetrically arranged the whole length of its abdomen. The *Odontostomus atratus* is a rapacious fish whose teeth are so large as to prevent its mouth from shutting. The specimen in the illustration has swallowed a cuttlefish, "whose breadth is much in excess of its own body." A remarkable peculiarity is that its eyes, which are lateral, can be turned to look upward. The specimen of the *Chiasmodus niger* here illustrated is six and five-eighths of an inch long, but contains a fish in its stomach which is ten and a half inches long. The stomach of the devourer is stretched as thin as gold-beater's skin. It has hooked teeth, and teeth which cross each other from opposite sides of the mouth. The teeth of these rapacious fishes of the deep sea usually point backward. According to Gunther, the fish, after having seized its victim with its capacious and very movable jaws, partly presses it down as a snake would do, and partly draws itself over it. The prey is received into an œsophagus and stomach, the membranes of which are extensible as an India-rubber pouch, and which, therefore, may "contain a body twice or thrice the size of the destroyer. The empty stomach is contracted and folded up, and projects but little below the abdomen."

The color of deep-sea fishes is commonly black or dark brown. But although it is claimed that light is essential to the formation of colors, some deep-sea fishes are scarlet in parts, or uniform red or rosy. Others are silvery white, while according to Alcock the *Neocopelus* is "one dazzling sheen of purple and silver and burnished gold, amid which is a sparkling constellation of luminous organs."

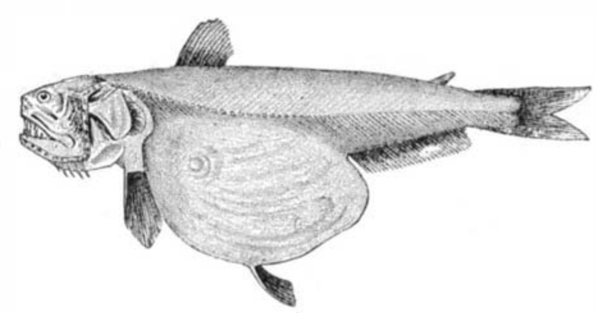
The bottom of the deep sea is apparently devoid of plant life except perhaps in the form of bacteria. There is, however, an abundance of slime comprising animalcules, which are constantly rained down from the upper strata, and which constitute the food of the toothless fishes. And as if to demonstrate the limited and circumscribed influence of environment, we here also find crabs, prawns, crayfish, shrimp, lobsters, mollusks, starfishes, sea-urchins, corals, sponges, protozoa, etc., which are not only identical in all essentials with shallow-water specimens, but also with specimens of the remotest geologic showing.

Much yet remains to be learned of the deep seas, for



LAMPROGRAMMUS NIGER (ALCOCK).

Indian " Fire-fish " with row of luminous scales.



ODONTOSTOMUS HYALINUS (COCCO).

Fish containing cuttle-fish broader than itself.

only within the last fifty years have they begun to be explored at all extensively.

A unique feature of a snowbound train recently was the setting up of telephonic communication between it and the outside world. The train became stalled in deep drifts in a small village some 25 miles from Buffalo. So deep was the snow that it was impossible for the passengers to leave the train. One of the passengers jocularly remarked that he would telephone home for his dinner. A telephone expert who was present heard the remark and afterward left the train, found a lineman and some wire in the village, and in two hours had a telephone installed in one of the cars. The instrument was connected to one of the long-distance lines, and for the fifteen hours the train was stalled it was kept in almost constant operation by the passengers, who talked easily with friends anywhere from 10 to 200 miles away.

Wood Preservative and Dry Rot Remedy.—Dissolve 15 kilos of trinitrophenol in a vessel in 35 kilos of hot water, and after the solution obtained in this manner has almost cooled, gradually enter 20 kilos of soda lye of 15 degrees Be., with continued slow stirring. By the addition of dyestuffs any desired color can be produced. This preparation has an excellent antiseptic action, and is a radical remedy for the eradication or prevention of dry-rot, delaying the rotting or molding of wood most effectively.—Der Chemisch-Technische Fabrikant.

RECENTLY PATENTED INVENTIONS.

Electrical Devices.

AUTOMATIC ALARM-TELEGRAPH.—A. D. Shaw, New York, N. Y. The inventor's principal object is to provide an instrument so constructed that when it is set to sound an alarm whenever burglars break into a house supplied therewith the circuit connecting the instrument with the door or window or other opening will be kept open until the time of the entry of the burglar, thus obviating the waste of the battery by which the current which operates the instrument is furnished and preventing the instrument from becoming inoperative through exhaustion of the battery.

ELECTRIC TEMPERATURE-ALARM.—C. P. Hepler, Smithton, Pa. The objects of this invention are to provide an alarm which will be adjustable, so that it may be set for any desired temperature, which will be entirely automatic in operation, and which will be useful to a large number of different kinds of manufacturers—for instance, distillers and brewers, bakers, confectioners, etc.

THIRD RAIL.—L. T. Crabtree, Crandon, Wis. Mr. Crandon's invention has reference to third rails, his more particular object being to produce a third rail which is made in sections which are energized independently of each other, the only portion of the rail energized at a time being that immediately under the car.

CONNECTION-BOX.—E. R. Le Manquais, New York, N. Y. The principal object of this invention, which relates to an outlet junction, cut-out, or connection-box for electrical wiring intended especially for buildings, is to form the box so that it may be constructed of parts which when kept continually on hand may be assembled two or more together to form a box of any size. This enables a contractor to quickly, cheaply, and conveniently assemble a box of the precise size necessary to the particular job on hand.

AUTOMATIC ELECTRIC RAILWAY-SIGNAL.—W. S. Jackson, Hoboken, N. J. This invention refers to signals especially designed for use in connection with single-track trolley-railways whereon cars are adapted to travel in opposite directions on the same track, although the improved devices may by modification in the system be employed on double-track railroads and on other kinds of railways than trolley-roads. One purpose is to provide an improved form of semaphore-controlling mechanism by which a number of cars traveling in the same direction may be admitted to a "block" or section of the railway in order to meet unusual demands of traffic in one direction over the railway.

Of Interest to Farmers.

TREE-PROTECTOR.—J. A. Perou, Los Angeles, Cal. The invention is especially applicable for use in growing eucalyptus-trees which are set out in great numbers for commercial purposes when very small and need protection against rabbits and other small animals until growth has attained the height of about two feet, after which the trees are seldom molested owing, probably, to increased bitterness of taste. When a plantation has reached this stage, the protectors can be taken away and used in other places.

MOWER-BAR.—O. R. Coe, Windham, N. Y. The object in this case is to produce a mower-bar of simple form which is so constructed as to prevent injury to the knives. A special object has been to provide an arrangement which tends to reduce the force necessary to actuate the knives and also minimize the danger of clogging or choking the knife. The invention relates to mower or cutter-bars such as used in the construction of mowing-machines and harvesters.

Of General Interest.

LACE-CARD.—J. W. Wolff, Ruralhall, N. C. Mr. Wolff's invention is an improvement in cards especially designed for application to lace already wound, although it may be employed in winding lace on the card. The improved card may be employed for holding ribbon, tape, and the like, and the clips used for fastening the ends of ribbons, tape, etc., as may be desired.

SUPPORT.—H. B. Wentworth, Middleboro, Mass. The invention relates to supports, and more particularly those adapted for use in connection with the horns of phonographs and the like. Its principal objects are to provide a simple and effective support which may be folded into compact form. When not in use the horn may be removed from the hook, the arms folded together until they are parallel to one another, and the head, standard, and base separated, the support then occupying but little space.

WOVEN PILE FABRIC.—H. Sarafian, Yonkers, N. Y. The object of the present invention is to provide a woven pile fabric in which the piles extend in one direction and a long pile can be used and at the same time an exceedingly-strong fabric can be readily produced on a loom of simple construction. The invention relates to woven pile fabrics such as shown and described in the Letters Patent of the United States formerly granted to Mr. Sarafian.

APPARATUS FOR MAKING BISULFITE.—G. A. Stebbins, Watertown, N. Y. The bisulfite liquor made by this apparatus is intended for use in conjunction with steam at high temperature for making wood-pulp and the like. The apparatus admits of general use, but is peculiarly applicable in instances where it is desired to pass the sulfurous gases through a basic solution so as to form the bisulfite liquor. The principal objects are to provide for cooling the gases and liquor during the process of its manufacture and to so distribute the gases as to expose a large surface thereof to the basic solution employed.

SELF-ADJUSTING PUMP-PLUNGER.—J. Reid, New York, N. Y. The improvement relates to plungers having metal or fiber packing, and especially adapted for hot-water pumps in heating systems. One purpose is to so construct the plunger that it will always remain in the center of the water-cylinder of the pump, thereby providing a water-cushion between the outer periphery of the plunger and the inner surface of the cylinder, thus preventing any wear on the latter.

APPARATUS FOR RAISING LIQUIDS FROM DEEP DRILLED WELLS.—T. F. Moran, DeYoung, and F. J. Moser, Kane, Pa. This invention admits of general use, but is particularly adapted for service in deep drilled wells that have a small diameter and in which the liquid is comparatively shallow, frequently failing to afford necessary submergence to seal the air without forming the liquid into a column of sufficient height above the level of the liquid in the well, so that it can be raised "plunger-like" from the well to the surface of the earth by the rapid and violent action of the air at high pressure.

DRAWING INSTRUMENT.—J. Hoffmann, New York, N. Y. In this instance the invention relates particularly to improvements in T-squares or right-line rules, an object being to provide a device of this character so constructed that it may be slid over a drawing without danger of blurring ink-lines that may not be dry, thus resulting in a saving of time in making drawings.

VALVE.—C. P. Carlin, Chicago, Ill. Mr. Carlin's invention relates to improvements in pressure-actuated valves, the object being to provide a valve of this character having very few and simple parts not liable to get out of order and that may be made at a comparatively small cost. In case this valve is used with an upright pipe the spring may be omitted and the valve closed by gravity.

GLASS-MOLD.—J. F. Buzby, Royersford, Pa. This mold is especially designed for molding glass insulators for wiring systems. Means are provided whereby a hole entirely through an article can be molded; also, means whereby another hole extending from the exterior surface of the article to the first hole can be efficiently formed. Also means for locking the mold parts together and for simultaneously unlocking the mold parts and withdrawing one of the cores are provided.

ADJUSTABLE INDEXING-CLIP.—C. C. Smith, Exeter, Neb. In carrying out this improvement the object is to provide an article capable of being quickly attached to a leaf of a book or a card, the clip being so constructed that its biting edges shall tightly grasp the leaf in such manner that it cannot be accidentally dislodged or pulled therefrom and neighboring cards or leaves cannot accidentally slip under or catch thereon, yet said clip can be immediately removed from one sheet or card and placed upon another. Perhaps the most important use for the clips is in connection with books or card-files, where by their symbols, colors, shapes, or positions they designate different cards, leaves, or divisions, so that such may be immediately picked out or referred to without handling other cards, etc.

Heating and Lighting.

HEATER.—W. Richter, New York, N. Y. The improvement relates to stoves such as are used for heating purposes and employing gas, vapors, or other oil fuel; and its object is to provide a heater which is durable in construction and arranged to provide a large heating-surface in a comparatively small space and to produce a proper circulation of the air and thorough heating thereof.

Household Utilities.

AWNING-LIFT.—H. T. Adams, New York, N. Y. In this case the invention relates to awnings and admits of general use, but is peculiarly adapted for service in connection with awnings of the kind usually lifted at will by hand. The awning operates on the principle of a spring shade roller and is self-raising, the power of the hand being partially applied while the awning is being lowered. This enables a person to handle it with little exertion and lessens danger of an accident caused by the frame being dropped too suddenly into lowermost position. A comparatively heavy awning can be safely manipulated by a child.

CLOSING DEVICE FOR WINDOWS.—W. S. Doe, Jersey City, N. J. The object of this invention is to provide a new and improved device for automatically closing a window when it begins to rain. The device is very simple and durable in construction, is not liable to get out of order, and is always in proper position to immediately close the window when it begins to rain, so that the window is automatically closed. In combination with the window-closing device are means for controlling it, these means normally holding the device in an inactive position and being sensitive to hydroscopic changes for releasing the closing device.

SINK-TRAP ATTACHMENT.—A. Savard, Omaha, Neb. The aim of the inventor is to provide a simple kitchen-sink attachment whereby the solid matter can be flushed directly into the trap in opening a suitable lid and within which is held a receptacle adapted to catch the solid matter, which receptacle can be readily removed to be emptied at suitable times. By this means the sink may be always kept clean and sightly, and when desired to clean the sink a simple lid is raised to remove the garbage-collecting receptacle.

Machines and Mechanical Devices.

INKING APPARATUS.—F. E. Kempf, Boston, Mass. The object of the present invention is to provide an inking apparatus arranged to insure an even and uniform distribution of the ink or color to permit of feeding more or less ink or color to the printing-cylinder for making a lighter or heavier impression. The present is a division of the application for Letters Patent of the United States for a multicolor printing press, formerly filed by Mr. Kempf.

APPARATUS FOR RECOVERING MINERALS.—F. S. Prouty, San Francisco, Cal. One of the principal objects of the invention is to effect the recovery or separation of gold and other minerals from the detritus or mixtures of water and earthy matters containing the same without the employment of an amalgamating substance, as quicksilver, for that purpose and also to overcome numerous disadvantages and objections found to exist with other apparatus or means hitherto devised with like objects in view.

VENDING-MACHINE.—W. McC. Mack, West Buxton, Maine. The invention relates to improvements in coin-controlled machines for vending cigars or like articles; and the object is the provision of a machine having a simple means for preventing the operation of the machine by the insertion of a coin or other device other than the coin for which the machine is adapted, and, further, to so construct the device that only one cigar can be delivered at a time.

PATTERN FOR CASTING GEAR-WHEELS.—T. W. Lowe, Stockton, Cal. In this case the object of the invention is to provide a new and improved pattern for casting gear-wheels and gear-racks arranged to permit the formation of gear-wheel patterns of any desired diameter, shape of teeth, pitch, etc., to insure casting of properly-meshing gear-wheels in a very simple and economical manner and without the use of the expensive gear-wheel patterns now employed.

MASSAGE APPARATUS.—J. C. Johansen, Osterbrogade 22, Copenhagen, Denmark. The present invention concerns a mechanical massage apparatus of special construction which makes it possible to use the apparatus for several different kinds of massage and which permits that the extent of the movement may easily be adjusted as required. When the invention is applied it is supposed to be affixed to an axle pliable when required, which rotates quickly, driven by a motor, a treading mechanism, or other power of transmission.

Prime Movers and Their Accessories.

VALVE.—J. J. Dunwoody, New York, N. Y. This invention relates to valves, and more especially to valves designed, primarily, for use on steam-pipes, but adapted for use in conduits for any fluid which does not have corrosive action upon the cylinders of the valve. One object is to provide a valve which is so constructed that the gland or stuffing-box ordinarily employed around the valve-stem to prevent escape of steam or other fluid between the valve-stem and casing may be dispensed with without allowing any escape of steam around the stem. A gate seat may be applied for use in large power houses to prevent blowing out of the packing.

LOW-WATER AND CIRCULATION ALARM FOR GASOLENE-ENGINES.—J. Schopbach, New York, N. Y. One purpose of the invention is to provide an electric alarm adapted for use in connection with the water-jacket of the cylinders of gasolene and like engines, which alarm will automatically act when the water in the tank is low and when circulation is impeded. Another is to provide a construction of alarm device for the purpose described which will be exceedingly simple and quick and positive in its action, economic and readily applied.

TRACK-SANDER.—A. B. Potts, Chattanooga, Tenn. The object in this instance is to provide a sander arranged to permit of being readily changed from a pneumatic track-sander to a gravity track-sander to prevent clogging of sand in the passage from the sand-box to the track to give access to the interior of the sand-trap for conveniently cleaning the trap and removing obstructions.

WATER-GAGE.—J. O'Connor, New Orleans, La. The aim of the inventor is the provision of a gage for steam-boilers and the like which is not liable to break as ordinary glass gages, and arranged to accurately show to the observing engineer the level of water in the boiler at all times irrespective whether the water is clear or contaminated with oil, sediment, and the like and liable to incrust or cover the inside of an ordinary glass tube and render reading of the glass gage difficult.

Railways and Their Accessories.

DEVICE FOR OPERATING CAR-BRAKES.—W. K. Smith, Werris Creek, New South Wales, Australia. In this patent the invention relates to an appliance by means of which the air-brakes of a railway train can be independently applied by a signalman or other person. The essential feature of the improvement is an adjustable block which can be secured to the insides of the rails or to a sleeper, so arranged that it can be made to come into operative contact with a tap especially provided on an extension of the pipe of the engine air-brake.

BRAKE.—A. E. Peters and E. E. Graham, Cleveland, Ohio. The invention resides especially in the structure and organization of the gear for connecting the braking-drum with the axle or other mobile part of the car and also in the peculiar manner of connecting the motor-car with a trailer or trailers, so as to apply the brake simultaneously to all of the cars. It particularly relates to a brake adapted for railway-cars and employing as its operating power the momentum of the car.

VESTIBULE-CAR. J. A. D'Hemecourt, New Orleans, La. This invention relates to vestibules of cars, and more particularly to those which extend the full width of the car and have the space between the platform and outer door closed by a trap. In such a structure the ordinary practice is to operate this trap from the inside before opening and after closing the door, the preparation for egress and ingress requiring two distinct operations. The principal object is to furnish means for simultaneously operating the door and trap.

COMBINED RAILWAY-CAR TRUCK AND FRAME.—W. H. Didlake, Chrystalsprings, Miss. Mr. Didlake's intention in this improvement is to secure a greater degree of safety as regards the separation of the car-body from the trucks to give the car a steadier motion and more elasticity of springs, to secure an easier adjustment of the wheels to the truck in turning curves, to lighten the construction of the car, and to secure other advantages.

Pertaining to Vehicles.

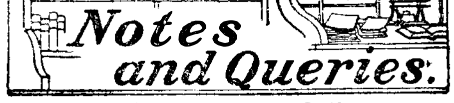
LOCK-SHOE.—W. C. Larison, Blossburg, Pa. The shoe is placed beneath the wheel and the chain attached to some portion of the vehicle, the side walls of a plate retaining it against movement laterally of the wheel. If the latter tends to slip or skid upon ice or inclined surfaces engaging projections will grip and tend to prevent this, their rounded form avoiding undue positive checking in vehicle's advance. If the wheel runs in the shoe, slipping under this action is avoided by the bringing of the rib teeth into contact with the supporting-surface, their sharp edges at once stopping this movement. Worn projections may be readily renewed, and fresh ones secured in place which renders other portions of the shoe practically indestructible.

UNICYCLE.—O. Jensen, New York, N. Y. The invention relates to unicycles, and more particularly to those which are power-driven. It has for its principal objects the provision of a convenient and readily-controlled vehicle of this character. The tractive effect is secured by the forward movement of the weight of motor and rider within the wheel and there can be no slipping of the latter upon the ground. Therefore the machine operates successfully over any surface—such as ice, for example—and will climb grades, its capacity being only limited by the power of the motor. The main wheel's great diameter renders it useful over rough country, ordinary obstacles presenting but slight obstruction.

TOY.—W. C. Soule, Savannah, N. Y. In this patent the invention refers to wheel toys; and the inventor's object in view is the provision of a toy of this character which shall be novel in construction and have power means which, when wound, will operate to propel the toy in one direction and automatically react, propelling it in the opposite direction.

DRAFT ATTACHMENT FOR VEHICLES.—G. H. Klugel, Thellman, Minn. This invention relates to an attachment, which may be applied to any kind of a vehicle but is especially adapted to two-horse wagons and the like. The principal object is to provide means for preventing the jar and swinging of the tongue which occurs when one of the wheels meets an obstruction or is raised for any reason. An important feature is the provision of means for permitting the front axle to be swung upon its pivot and also to be swung vertically without bringing most of the strain upon one of the draft animals and also for equalizing the strain upon the animals when one tends to take a larger part of the load.

Note.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.



HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

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(9543) A. S. L. asks: Will you kindly explain the following peculiar weather conditions? There was a fall of 2 inches of fine snow in this vicinity recently with the thermometer at 36 degrees, or 4 degrees above freezing, wind from the south, and the snow did not melt after falling. Last year we had a rain storm from the northeast, with the thermometer at 23 degrees, or 9 degrees below freezing, and the rain freezing after falling. In the latter case the thermometer rose slowly. A. The fall of snow when the temperature at the surface of the earth is above freezing is due to the fact that the temperature at the altitude of the clouds is below freezing. That the snow did not melt after falling was due to the cooling of the air so that the temperature was soon at freezing. The fall of rain when the temperature at the surface of the earth is below freezing is due to the opposite state of affairs; the temperature in the clouds is above freezing, warmer than it is below. That the temperature rose after the fall of rain took place may be explained by the heat which the rain gave off in cooling to the freezing point and freezing.

(9544) H. W. says: Kindly answer the following questions in the column of your paper entitled Notes and Queries, viz.: 1. How is the power of a gasoline engine calculated? A. It is very difficult to accurately calculate the power of a gasoline engine. The horse-power is equal to the area of the piston in square inches, multiplied by the length of the stroke in feet, multiplied by the number of working strokes per minute, multiplied by the average pressure per square inch behind the piston, divided by 33,000. All of the quantities are easily determined excepting the average pressure in the cylinder. This will vary very greatly, according to the character and design of the engine and the richness of the mixture, the degree of compression and the time of ignition. As a general average, it would vary between 50 and 150 pounds. 2. To what temperature is the air in the cylinder of a gasoline engine heated by the combustion of the gasoline? A. The temperature in the cylinder of a gasoline engine is even more difficult to determine than the average or maximum pressures. It would also depend on the richness of the mixture, the degree of compression, the size and shape of the cylinder, the efficiency of the cooling jacket, if there be any, and the time and character of the ignition. The maximum temperature probably varies between 1,500 and 2,500 degrees; but all parts of the mixture might not have these temperatures at the same time.

(9545) H. F. W. asks: In thinking of the power of gravitation and the resultant weight of objects and incidentally of the power of magnetism, electricity, etc., the query arose in my mind: "How is weight affected by distance from the earth?" I wondered if this had ever been experimented with. I queried what is the proportionate loss of weight of objects carried to the greatest height attained by balloons, say approximately 5 miles. Of course, in determining this balances or steel yards could not be used; but spring scales probably could be used so as to determine the loss of weight and the percentage thereof. A. Sir Isaac Newton, who died March 20, 1727, fully investigated the action of gravitation, and determined the law of the weight of bodies at all distances from the center of the earth. It is that the weight decreases at the same rate as the square of the distance from the center of the earth increases. If anything weighs 100 pounds at the level of the sea on the earth, at twice the distance from the center of the earth that body will weigh only one-quarter as much. Taking the surface of the earth as 4,000 miles in round numbers from the center, twice as far would be 8,000 miles; at 8,000 miles from the center of the earth, the weight which was 100 pounds at sea level will have decreased to 25 pounds. At 5 miles above the surface of the earth, the change of weight will be in the ratio of $4,000^2$ to $4,005^2$. This decrease is very slight for short distances. As you say, it cannot be detected with a steelyard. A spring balance would give the change of weight if it were delicate enough. A pendulum is, however, the instrument actually employed for the purpose, since its time of swing depends upon the force of gravitation.

(9546) G. A. D. asks: Will you kindly mail me the answer to the following question, which is a branch of electro-plating? I wish to know how the color termed "verdigreen" is produced on the surface of brass, or, in other words, how I am to produce a color which looks as though brass has been buried and verdigris has formed thickly on the same. I have a number of brass wall plates on which are set electric push buttons. The plates are 6 inches by 10 inches. A. A green coating is obtained upon brass by the use of verdigris, which is called in chemistry acetate of copper, or by carbonate of copper, or by a mixture of the two to the tint desired. This is mixed with a light-colored varnish and applied to the article with a brush, and the high parts are immediately wiped off with a rag wet with the liquid in which the varnish was dissolved. This may be alcohol. A smooth coating should be left. A coating of clear lacquer is put over the whole when the varnish is dry. There is no need of electricity in doing this. It is a process in lacquering. It is more fully described in Van Horne's "Modern Electroplating," which we send for $1.

(9547) R. M. G. says: 1. Can you inform me what coefficient of friction to use in figuring the power of multiple-disk friction clutches? Surfaces to be cast iron to cast iron, running in oil. A. We know of no published data giving the coefficience of friction on friction clutches. For a clutch running in oil, we should not consider it safe to use a coefficient larger than about 0.05. 2. Example: How many surfaces would be required to transmit, from rest, a torque equal to 1,000 pounds pull on a 3 3-16-inch radius (i. e., radius equal to the effective radius of the disks)? Clutch disks 8 inches diameter, 4-inch hole = 37.69 sq. in. effective area. R = about 3 3-16 ins. Pressure on clutch plates, 100 pounds. A. Assuming the coefficient of friction on the clutch you mention, it would require 200 surfaces. 3. What is the better way to increase the power—by increasing the area, the number of surfaces, or the pressure? A. The best way of increasing the power of a friction clutch is first by increasing its diameter, thereby increasing the lever arm through which the force acts; second, by increasing the pressure; third, by increasing the number of surfaces in contact. Increasing the area of the surfaces without increasing the pressure has no effect. 4. Can you refer me to some work that treats of this subject fully? A. We are sorry that we cannot refer you to any work that treats of this subject. We think you will find of interest an article on clutches in SUPPLEMENT 1448.

(9548) W. H. D. asks: Have you a SUPPLEMENT which fully gives the cubical difference in pipes and their capacity for delivering water under given pressure or fall, say 10 feet to 100 feet to run? I confess the most abject ignorance of a principle, and I know there is one; for instance, the difference in the carrying capacity of a ⅜ and ½ pipe, ⅞ and ¾, etc. I notice my pipe, ⅜ new lead, 35 rods, 67 feet fall, gave me (old-fashioned milk measure) 1 quart in 19 seconds; the decline continuous, but I am not helped out on the point I am after, for the ½-inch lead pipe, same fall, only favors me about 5 seconds. A. We refer you to an article on the flow of water through pipes, in SUPPLEMENT No. 791, price ten cents mailed. The question of determining a quantity of water which will flow under a given head from a long pipe is a very complicated one, because the coefficient of friction is not constant, but varies with the size of the pipe and the velocity of flow. The formula which is usually used to determine the velocity at the further end of the pipe is as follows:

$$h = \frac{v^2}{2g} \times \left(l + 4f \times \frac{l}{d}\right).$$

Where h = the head in feet.
v = the velocity in feet per second.
g = 32.2.
l = the length of the pipe in feet.
d = the diameter of the pipe in feet.
f = the coefficient of friction.

The value of f varies from 0.008 to 0.006 for a 3-inch pipe, as the velocity of flow in the pipe increases from 1-10 of a foot per second to 20 feet per second; while with a half-inch pipe it varies from 0.0150 to 0.006 under the same circumstances. From the above you can roughly estimate the proper coefficient of friction for a given pipe and a given velocity. Substitute this coefficient of friction in the formula given above, and determine the velocity with which the water will issue from your pipe at the further end by solving the equation for v. When the velocity is known, the quantity may be determined by the formula:

$$Q = 0.78d^2v.$$

Where Q = the flow of water in cubic feet per second, and d = the diameter of the pipe in feet.

(9549) M. E. asks: I want a book that will explain to me how the megaphone works. You sent me your catalogue of scientific books, and I fail to find such a thing in it. It is an instrument that will magnify sound, somewhat resembles an opera-glass. A. A megaphone is simply a very much enlarged horn, with a mouthpiece into which one may talk or shout. The horn directs the sound out in a narrow lane in the direction in which it is pointed. It is simply a speaking trumpet of olden time employed to direct the sound of a phonograph. From this it has passed into quite general use by people who need to be heard a longer distance than the voice can be heard if it spread out from the mouth into a sphere, as it will do if not prevented from doing so. A megaphone may be made of cardboard or stiff paper or metal.

NEW BOOKS, ETC.

A HISTORY OF COLUMBIA UNIVERSITY. 1754-1904. New York: Columbia University Press, The Macmillan Company agents, 1904. 8vo.; pp. 493. Price, $2.50.

The present volume was published in commemoration of the one hundred and fiftieth anniversay of the founding of King's College. A complete history of any university is of value, not only to its alumni, but to the general reader as well. The dignified position held by Columbia is exemplified in the work before us. The foundation of King's College, the various presidents, the development of the university, and the graduate and other courses come in for proper attention.

POULTRY FEEDING AND FATTENING. Compiled by George B. Fiske. New York: Orange Judd Company, 1904. 16mo.; pp. 160. Price, 50 cents.

This work includes the preparation for market, special finishing methods as practised by American and foreign experts, handling broilers, capons, water fowl, etc. The book is adequately illustrated, and will prove useful to all who are engaged in the raising of poultry for profit.

PRIVATE HOUSE ELECTRIC LIGHTING. By Frederic H. Taylor. London: Percival Marshall & Co., N. D. 16mo.; pp. 128. Price, 40 cents.

A popular handbook of modern methods in wiring and fitting, as applied to private houses, including a chapter on small generating plants. The practice is of course English.

ELEMENTS OF YACHT DESIGN. By Norman L. Skene, S.C. New York: The Rudder Publishing Company, 1904; 8vo.; pp. 86. Price, $1.

This work is a compact and practical presentation of the processes involved in designing the modern yacht. We have long felt that there was a place for a work of this character, in which modern methods of design and modern materials of construction are explained and illustrated. The work is not overburdened with mathematical and theoretical presentations, and the methods shown may be readily understood by men who are not favored with technical training. The various operations involved in designing a sailing yacht are illustrated by giving the work necessary in the design of a 30-foot waterline sloop, whose working plans are given in full in several full-page plates. The complete data for the design are given in the appendix.

LAIRD & LEE'S VEST POCKET WEBSTER PRONOUNCING DICTIONARY. 27,500 Words. Chicago: Laird & Lee. 24mo.; pp. 199. Price, cloth, 25 cents; leather, 50 cents.

SUBJECT LIST OF WORKS ON THE FINE AND GRAPHIC ARTS (INCLUDING PHOTOGRAPHY) AND ART INDUSTRIES IN THE LIBRARY OF THE ENGLISH PATENT OFFICE. London: Published at the Patent Office, 1904. 32mo.; pp. 374. Price, 25 cents.

This list comprises 2,916 works and (189 serials, 2,727 text books, etc.), representing some 5,373 volumes. The catalogue entries relating to these works number 3,645 and are distributed under 518 headings and sub-headings.

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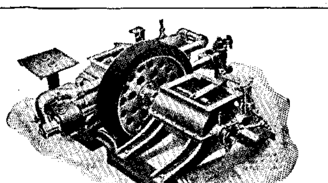

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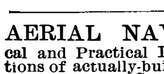

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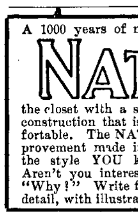

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"The Duchess Hair Pins," for hair pins, E. & J. Bass	11,887
"Tip Top Hair Pins," for hair pins, E. & J. Bass	11,886
"White Flake," for lard compound, Kentucky Packing & Provision Co.	11,905

PRINTS.

"Behind The Times Up to Date," for beer taps and bushes, American Tap Bush Co	1,220
"Spring 1905," for clothing, Federal Lithograph Co.	1,214
"Spring & Summer 1905," for clothing for evening wear, Federal Lithograph Co.	1,215
"Spring & Summer 1905," for clothing, Federal Lithograph Co. 1,217 to	1,219
"Stone's Moth Powder," for moth powder, Stone's Moth Powder Co.	1,223
"Summer 1905," for clothing, Federal Lithograph Co.	1,216
"The Eureka The Standard Water Softener of the World," for water softening apparatus, H. Romunder	1,222
"Tulepo Hair Restorer and Dandruff Cure," for hair restorer, J. F. Bradley	1,221

A printed copy of the specification and drawing of any patent in the foregoing list, or any patent in print issued since 1863, will be furnished from this office for 10 cents, provided the name and number of the patent desired and the date be given. Address Munn & Co., 361 Broadway, New York.

Canadian patents may now be obtained by the inventors for any of the inventions named in the foregoing list. For terms and further particulars address Munn & Co., 361 Broadway, New York.